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ABSTRACT

This volume is the third of four volumes that comprise a curriculum guide for a postsecondary industrial maintenance program. It contains part of section 3 of the guide which contains the unit guides for 10 of the 12 duties included in the course. Each of the 247 tasks included in these 10 duties is presented on a separate page and contains the following information: task, performance objective, instructional activities, suggested instructional materials, evaluation, and class and lab hours. Topics covered are machine shop; welding; oxyacetylene welding, cutting, brazing, and soldering; shielded arc welding; air conditioning and heating; heating; sheet metal; vehicle maintenance; automotive systems repair; and carpentry. (YLB)

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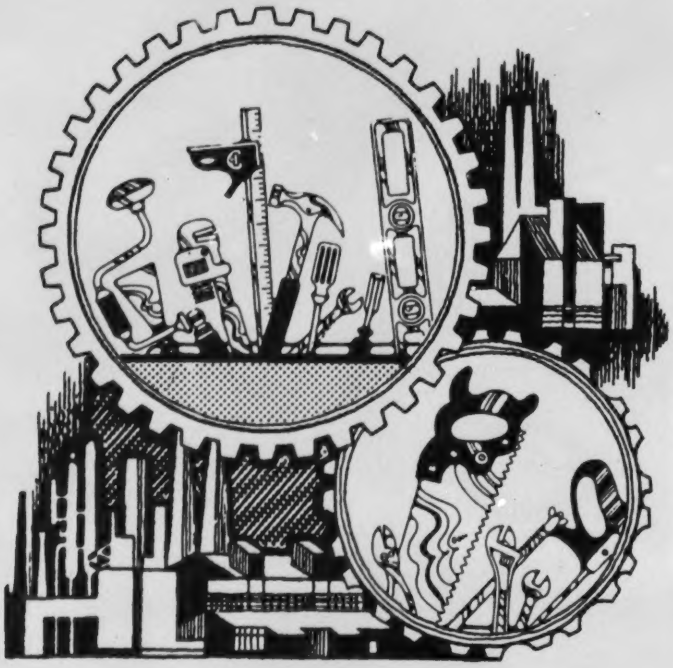
INDUSTRIAL MAINTENANCE

Post Secondary



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CE 032 076

VOLUME II-B

CURRICULUM GUIDE

Georgia Department of Education

INDUSTRIAL MAINTENANCE

Developed Under Contractual Agreement with

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Georgia Department of Education
Atlanta, Georgia 30334
Charles McDaniel, State Superintendent of Schools
1981

INDUSTRIAL MAINTENANCE

VOLUME II-B

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Division of Vocational Education

College of Education

Dr. George L. O'Kelley, Jr.

Division Chairman

INDUSTRIAL MAINTENANCE - VOLUME II-B

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SECTION III

UNIT GUIDES

TASK

MS-01 Laying out metal surfaces

PERFORMANCE OBJECTIVE

Layout a metal surface.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Tools used for laying out and scribing lines
b. Scribers
    1. Construction
    2. Keeping the point sharp
c. Kinds of mixtures which produce a white coating
d. Copper sulphate solution
e. Blueing a steel surface
f. Cleanliners
g. Laying out angular lines
h. Grinding points of punches
    1. Center punch
    2. Prick punch
i. Using dividers

(Continued on back)

Provide Demonstration On:

a. Marking a metal surface
b. Scribing a metal surface
c. Locating the center point on round stock

Provide Practical Application On:

a. Using a scriber to mark a circle, arc and straight line on a metal surface
b. Locating and marking the center point on round stock

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Machine Tool Operation, Part I
b. Porter, Machine Shop Operations and Setups

A/Vs:

a. Bergwall, "Bench Metal Work," filmstrip
b. Prentice-Hall, "Machine Shop: Bench Operations," filmstrip

Student Manuals:

Ohio, Machine Trades I, Bench-Work Assignment Sheet #1

Tools and Equipment:

a. Scribing tools
b. Marking supplies
c. American Machinist's Handbook
d. Machinery Handbook

LAB HOURS 2

CLASS HOURS 2

EVALUATION (MS-01)

a. Given appropriate tools, supplies and equipment, the student will accurately lay out metal work by scribing or marking circles, arcs and straight lines and marking the center point of round stock.

b. V'TECS, Machine Shop, Task No. 22.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

j. Using hermaphrodite calipers
k. Surface plate
l. Use of Vee blocks
m. Centering round stock
    1. Methods
    2. Tools used

TASK

MS-02 Identifying jig buttons

PERFORMANCE OBJECTIVE

Identify jig buttons.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Jig buttons
    1. Purpose
    2. Location on the work
    3. Instruments used to set buttons
    4. Tightening the screws
b. Using the parallel and micrometer
c. Using the height gage
d. When jig buttons are removed
e. Laying out equally spaced holes on a circle

Provide Demonstration On:

a. Setting jig buttons
b. Laying out equally spaced holes on a circle

Provide Practical Application On:

a. Locating and setting jig buttons
b. Laying out equally spaced holes on a circle

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Machine Tool Operation, Part I
b. Kibbe, Machine Tool Practices

Student Manuals:

Ohio, Machine Tools I, Bench-Work Assignment Sheet #2

Tools and Equipment:

a. American Machinist's Handbook
b. Jig button
c. Screw
d. Washer
e. Parallel

(Continued on back)

LAB HOURS	1
CLASS HOURS	1

EVALUATION (MS-02)

Given appropriate tools, supplies and equipment, the student will accurately layout and set jig buttons and also layout equally spaced holes in a given circle.

INSTRUCTIONAL MATERIALS

Tools and Equipment:

f. Micrometer
g. Height gage

TASK

MS-03 Using the sine bar

PERFORMANCE OBJECTIVE

Use the sine bar.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Sine bar
    1. Purpose
    2. Method of use
    3. Construction (Kind of steel)
b. Sine bar application
    1. Items that can be checked
    2. Jo-block
c. Trigonometric functions
    1. Formula
    2. Right triangle
d. Adjustable angle plates

Provide Demonstration On:

a. Using the trigonometry formula for setting the sine bar
b. Measuring an angle with the sine bar

Provide Practical Application On:

a. Sketching a surface plate with a two-inch Jo-block and an angle plate mounted with a five inch sine bar
b. Measuring an angle using the sine bar

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Machine Tool Operation, Part I
b. Porter, Machine Shop Operations and Setups

A/Vs:

Bergwall, "Measuring Tools Explained," filmstrip

Student Manuals:

a. Ohio, Machine Trades I, Bench Work Assignment Sheet #3
b. Machine Stop Training Course, Vol. 1

Tools and Equipment:

a. American Machinist's Handbook
b. Machinery's Handbook
c. Sine bar
d. Jo-blocks

LAB HOURS	2
CLASS HOURS	2

EVALUATION (MS-03)

a. Given an assigned measurement, the student will accurately measure an angle using the sine bar. The instructor will check the student's results for accuracy.

b. V'TECS, Machine Shop, Task No. 40.

TASK

MS-04 Using the bevel protractor

PERFORMANCE OBJECTIVE

Use a bevel protractor.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Bevel protractor
   1. Application
   2. Maximum revolution
   3. Value of the divisions on the vernier scale
   4. Maximum reading on the scale

b. Measuring angles greater than 90°

Provide Demonstration On:

a. Reading the scale on a bevel protractor

b. Making a greater than 90° measurement

Provide Practical Application On:

a. Measuring an angel and reading the scale on the bevel protractor

b. Measuring an angle which is greater than 90°

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Machine Tool Operation, Part I

b. Kibbe, Machine Tool Practices

A/Vs:

Bergwall, "Measuring Tools Explained," filmstrip

Student Manuals:

Ohio, Machine Trades I, Bench Work Assignment Sheet #4

Tools and Equipment:

Bevel protractor

LAB HOURS	1
CLASS HOURS	2

EVALUATION (MS-04)

Given a bevel protractor and an assigned measurement, the student will accurately read the measurement. The measurement may be of an angle which is greater than 90°.

TASK

MS-05 Using steel rules

PERFORMANCE OBJECTIVE

Use steel rules.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Types of steel rules
b. Types of scales on the rule
c. Reading the scales
d. Using a short length rule
e. Adding fractions
f. Reducing a fraction to lowest terms

Provide Demonstration On:

a. Using a short length rule
b. Adding fractions
c. Reducing fractions to lowest terms

Provide Practical Application On:

Using a steel rule to make an assigned measurement

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Machine Tool Operation, Part I
b. Kibbe, Machine Tool Practices
c. Porter, Machine Shop Operations and Setups

A/Vs:

a. Bergwall, "Bench Metal Work," filmstrip
b. Prentice-Hall, "Machine Shop: Bench Operations," filmstrip

Student Manuals:

Ohio, Machine Trades I, Bench Work Assignment Sheet #5

Tools and Equipment:

Steel ruler

LAB HOURS	2
CLASS HOURS	2

EVALUATION (MS-05)

Given a steel rule and an assigned measurement, the student will make the measurement to an accuracy of 1/64 inch and reduce the fractional reading to lowest terms. The instructor will check the student's reading.

TASK

MS-06 Using the micrometer

PERFORMANCE OBJECTIVE

Use the micrometer.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Types of micrometers
   1. Screw thread micrometer
   2. Outside micrometer
   3. Inside micrometer
   4. Micrometer depth gages

b. Caring and maintaining micrometers

c. Using micrometers

d. Temperature factors

e. Parts of a standard micrometer

Provide Demonstration On:

Using a micormeter to measure outside diameter, inside diameter

Provide Practical Application On:

Naming the standard parts of a micrometer

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Machine Tool Operation, Part I

b. Kibbe, Machine Tool Practices

c. Porter, Machine Shop Operations and Setups

A/Vs:

Bergwall, "Measuring Tools Explained," filmstrip

Student Manuals:

Ohio, Mahcine Trades I, Bench Work Assignment Sheet #6

Tools and Equipment:

Micrometer

LAB HOURS 4

CLASS HOURS 2

EVALUATION (MS-06)

a. Given a micrometer and an assigned measurement, the student will read a measurement to an accuracy of three places. The student will identify and choose the appropriate micrometer to measure inside diameter, outside diameter, screw threads and depths.

b. V'TECS, Machine Shop, Task No. 19.

TASK

MS-07 Reading a vernier scale

PERFORMANCE OBJECTIVE

Read a vernier scale.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Divisions of the vernier scale
b. Reading a scale
c. Reading a vernier micrometer
    1. Vernier reading
    2. Thimble reading

Provide Demonstration On:

a. Reading a vernier caliper
b. Reading a vernier micrometer

Provide Practical Application On:

Making assigned measurements with a vernier caliper and a vernier micrometer

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Machine Tool Operation, Part I
b. Kibbe, Machine Tool Practices
c. Porter, Machine Shop Operations and Setups

A/Vs:

Bergwall, "Measuring Tools Explained," filmstrip

Student Manuals:

Ohio, Machine Trades I, Bench Work Assignment Sheet #7

Tools and Equipment:

a. Calipers (vernier)
b. Micrometers (vernier)

LAB HOURS 2
CLASS HOURS 2

EVALUATION (MS-07)

Given a vernier caliper and a vernier micrometer, the student will make assigned measurements and read the scales to an accuracy of four places.

TASK

MS-08 Using dial indicators, center testers and speed indicators

PERFORMANCE OBJECTIVE

Use dial indicators, center testers and speed indicators.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Dial indicators
b. Center testers
c. Speed indicators
d. The center punch mark
e. Types of graduations found on a dial indicator

Provide Demonstration On:

a. Using a dial indicator
b. Using a center tester
c. Using a speed indicator

Provide Practical Application On:

Using a dial indicator, center tester and speed indicator to set up and inspect work for roundness, concentricity, straight and parallel surfaces

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Machine Tool Operation, Part I
b. Kibbe, Machine Tool Practices
c. Porter, Machine Shop Operations and Setups

Student Manuals:

a. Ohio, Machine Trades I, Bench Work Assignment Sheet #8
b. Machine Shop Training Course, Vol. 1

Tools and Equipment:

a. American Machinist's Handbook
b. Dial indicators
c. Wigglers on center finders
d. Speed indicators

LAB HOURS	4
CLASS HOURS	2

EVALUATION (MS-08)

a. Given a dial indicator, center tester and speed indicator, the student will correctly use these instruments to set up and inspect work for roundness, concentricity, straight and parallel surfaces.

b. V'TECS, Machine Shop, Task No. 36.

TASK

MS-09 Using precision gage blocks, tapered ring, plug and snap gages

PERFORMANCE OBJECTIVE

Use precision gage blocks, tapered ring, plug and snap gages.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Gage blocks
    1. Description
    2. Uses
    3. Sizes
b. Using gage block combinations
c. Using gage blocks to check micrometer accuracy
d. Using a taper gage (figuring the taper)
e. Using a snap gage
    1. Sizes
    2. Tolerance

Provide Demonstration On:

a. Using gage blocks
b. Using a taper gage
c. Using plug and snap gages

Provide Practical Application On:

a. Using a combination of gage blocks to check a measurement for accuracy
b. Using a taper gage to calculate taper
c. Using plug and snap gages to measure a given dimension

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Machine Tool Operation, Part I
b. Kibbe, Machine Tool Practices
c. Porter, Machine Shop Operations and Setups

A/Vs:

Bergwall, "Measuring Tools Explained," filmstrip

Student Manuals:

a. Ohio, Machine Trades I, Bench Work Assignment Sheet #9
b. Machine Shop Training Course, Vol. I.

Tools and Equipment:

a. Precision gage blocks
b. Tapered ring gage
c. Plug and snap gages
d. American Machinist's Handbook

LAB HOURS	4
CLASS HOURS	2

EVALUATION (MS-09)

a. Given an assigned series of measurements, the student will properly use gage blocks, a taper gage and plug and snap gages to make accurate measurements according to proper procedures.

b. V'TECS, Machine Shop, Task Nos. 37 and 38.

TASK

MS-10 Identifying and using hand hacksaws

PERFORMANCE OBJECTIVE

Identify and use hand hacksaws.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Testing a material with a file prior to sawing
b. Saw blades
    1. Teeth-per-inch
    2. Types
    3. Tightening a blade
    4. Types, sizes
c. Using the vise (Using pieces of wood for chips, pieces)
d. Layout line

Provide Demonstration On:

a. Installing a hacksaw blade
b. Using a hacksaw

Provide Practical Application On:

Choosing a hacksaw blade, installing it on a saw and cutting an assigned piece of material

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, *Machine Tool Operation*, Part I
b. Kibbe, *Machine Tool Practices*
c. Porter, *Machine Shop Operations and Setups*

A/Vs:

a. Bergwall, "Bench Metal Work," filmstrip
b. Prentice-Hall, "Machine Shop: Bench Operations," filmstrip

Student Manuals:

Ohio, *Machine Trades I*, Bench Work Assignment Sheet #10

Tools and Equipment:

a. *Machinist's Handbook*
b. Hacksaw
c. Vise
d. Hacksaw blades

LAB HOURS	1
CLASS HOURS	2

EVALUATION (MS-10)

a. Given a hacksaw and a selection of blades, the student will select and install the appropriate blade to cut an assigned piece of metal and cut the metal to a specified dimension using appropriate hand hacksaw procedure.

b. V'TECS, Machine Shop, Task Nos. 28 and 41.

TASK

MS-11 Using abrasives and lapping compounds

PERFORMANCE OBJECTIVE

Use abrasives and lapping compounds.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Abrasives
    1. Natural types
    2. Manufactured types
b. Laps of soft materials
c. Materials used for laps
d. Scoring or grooving laps
    1. Purpose
    2. Procedure
e. Lapping flat surfaces
f. Emery cloth
g. Buffing

Provide Demonstration On:

a. Lapping a surface
b. Smoothing a surface using emery cloth

Provide Practical Application On:

a. Lapping a surface
b. Using emery cloth to smooth a metal surface

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Machine Tool Operation, Part I
b. Kibbe, Machine Tool Practices
c. Porter, Machine Shop Operations and Setups

A/Vs:

Bergwall, "The Lathe Explained," filmstrip

Student Manuals:

Ohio, Machine Trades I, Bench Work Assignment Sheet #11

Tools and Equipment:

a. American Machinist's Handbook
b. Machinery's Handbook
c. Emery cloth
d. Lapping compound
e. Vise

LAB HOURS	2
CLASS HOURS	2

EVALUATION (MS-11)

Given a soft or hard metal surface, the student will obtain a fine and smooth surface using abrasives and lapping compound.

TASK

MS-12 Identifying and using files

PERFORMANCE OBJECTIVE

Identify and use files.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Single cut files
b. File teeth
c. File faces
d. One-half round files
e. The parts of a file
f. Double cut files

Provide Demonstration On:

Using a file

Provide Practical Application On:

Using a file on a given piece of material

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Machine Tool Operation, Part I
b. Kibbe, Machine Tool Practices
c. Porter, Machine Shop Operations and Setups

A/Vs:

a. Bergwall, "Bench Metal Work," filmstrip
b. Prentice-Hall, "Machine Shop: Bench Operations," filmstrip

Student Manuals:

Ohio, Machine Trades I, Bench Work Assignment Sheet #12

Tools and Equipment:

Files

LAB HOURS 1

CLASS HOURS 2

EVALUATION (MS-12)

a. Given a piece of metal with a rough edge, the student will correctly select a file and smooth the edge following correct procedures.

b. V'TECS, Machine Shop, Task No. 33.

TASK

MS-13 Scraping flat and curved bearing surfaces

PERFORMANCE OBJECTIVE

Scrape flat and curved bearing surfaces.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Materials used for surface plates
b. Purpose of scraping
c. Using a straight edge for scraping
    1. Procedure
    2. Purpose
d. Scrapers
    1. Materials made of
    2. Types of
e. Marking materials used in scraping
f. Figuring the list price of cast iron surface plate

Provide Demonstration On:

a. Scraping a surface plate
b. Calculating list price of cast iron surface plate

Provide Practical Application On:

Scraping bearing surfaces to smoothness

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Machine Tool Operation, Part I
b. Kibbe, Machine Tool Practices
c. Porter, Machine Shop Operations and Setups

A/Vs:

Bergwall, "Bench Metal Work," filmstrip

Student Manuals:

Ohio, Machine Trades I, Bench Work Assignment Sheet #13

Tools and Equipment:

a. Scraper
b. Marking tools

LAB HOURS 1

CLASS HOURS 2

EVALUATION (MS-13)

Given a bearing surface, the student will choose the appropriate tools and scrape the surface to smoothness.

TASK

MS-14 Using hammers and screwdrivers for hand bench use

PERFORMANCE OBJECTIVE

Use hammers and screwdrivers for hand bench use.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Main parts of a machinist's hammer
b. Hammer safety
c. Soft hammer heads
d. Types of hammers
e. Hammer handles
f. Screwdriver safety
g. Grinding a screwdriver
h. Choosing a screwdriver

Provide Demonstration On:

a. Tightening a hammer head
b. Grinding a screwdriver

Provide Practical Application On:

a. Using a hammer to ding a metal surface
b. Grinding a screwdriver head

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Machine Tool Operation, Part I
b. Kibbe, Machine Tool Practices
c. Porter, Machine Shop Operations and Setups

A/Vs:

Bergwall, "Bench Metal Work," filmstrip

Student Manuals:

Ohio, Machine Trades I, Bench Work Assignment Sheet #14

Tools and Equipment:

a. Hammers
b. Screwdrivers
c. Grinding wheel

LAB HOURS	1
CLASS HOURS	2

EVALUATION (MS-14)

Given a hammer and a screwdriver, the student will use the tools for an assigned task observing correct procedure and safety practices.

TASK

MS-15 Identifying and using wrenches

PERFORMANCE OBJECTIVE

Identify and use wrenches.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Wrenches
   1. Types
   2. Safety
   3. Leverage
   4. Safety
b. Using an adjustable wrench
c. Holding and checking nuts
d. Checking nut tightness

Provide Demonstration On:

Using wrenches
1. Open end
2. Box end
3. Adjustable
4. Spanner types

Provide Practical Application On:

Identifying and using several different types of wrenches

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Machine Tool Operation, Part I
b. Kibbe, Machine Tool Practices
c. Porter, Machine Shop Operations and Setups

A/Vs:

Bergwall, "Bench Metal Work," filmstrip

Student Manuals:

Ohio, Machine Trades I, Bench Work Assignment Sheet #15

Tools and Equipment:

a. Wrenches
b. American Machinist's Handbook
c. Machinery's Handbook

LAB HOURS	1
CLASS HOURS	2

EVALUATION (MS-15)

Given a selection of wrenches and an assigned nut to tighten, the student will select the appropriate wrench and follow correct safe procedures to tighten the nut.

TASK

MS-16 Using bench vises and clamps

PERFORMANCE OBJECTIVE

Use the bench vise or clamps.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Types of vises
b. Kinds of metals vises are made of
c. False protective jaws
d. Parts of a bench vise
e. How a vise is fastened to a bench

Provide Demonstration On:

Fastening materials in a bench vise

Provide Practical Application On:

Using a bench vise to hold material for bench work operation

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Machine Tool Operation, Part I
b. Kibbe, Machine Tool Practices
c. Porter, Machine Shop Operations and Setups

Student Manuals:

Ohio, Machine Trades I, Bench Work Assignment Sheet #16

Tools and Equipment:

a. Machinery's Handbook
b. Bench vise or clamp

LAB HOURS	1
CLASS HOURS	2

EVALUATION (MS-16)

Given a material to bend, chip, polish, file or perform other bench work on, the student will secure the material in a bench vise by following correct procedures and all related precautions.

TASK

MS-17 Identifying and using chipping tools

PERFORMANCE OBJECTIVE

Identify and use chipping tools.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Angles between facets of a chisel
b. Types of chisels
c. Chipping guard
d. Chipping a keyway
e. Safety
f. Amount of material to leave for finishing

Provide Demonstration On:

a. Choosing a chisel
b. Proper use of a chisel

Provide Practical Application On:

Using a chisel for an assigned chipping operation

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Machine Tool Operation, Part I
b. Kibbe, Machine Tool Practices
c. Porter, Machine Shop Operations and Setups

Student Manuals:

a. Ohio, Machine Trades I, Bench Work Assignment Sheet #17
b. Machine Shop Training Course, Vol. 2

Tools and Equipment:

a. Chipping tools
b. Vise
c. Machinery's Handbook

LAB HOURS	1
CLASS HOURS	2

EVALUATION (MS-17)

Given an assigned chipping to be done, the student will choose the correct type of chisel and use the chisel to chip the material to appropriate tolerances. The student will follow all procedures and safety precautions.

TASK

MS-18 Using hand taps, dies and hand reamers

PERFORMANCE OBJECTIVE

Use hand taps, dies and hand reamers.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Threads
   1. National Fine (N.F.)
   2. National Coarse (N.C.)
b. Tapering pipe taps
c. Bottom taps
d. Tap sets
e. Plug taps
f. Blind hole
g. Pulley tap
h. Tap drill
i. Tap drill sizing formula
j. Tap safety
k. Dies
   1. Threading dies
   2. Solid threading dies
   3. Adjustable die
   4. Die stock

(Continued on back)

Provide Demonstration On:

a. Checking a tap for square alignment with a hole
b. Using tap set
c. Cutting threads using a die set

Provide Practical Application On:

a. Tapping a hole with a handtap
b. Cutting threads with a hand die

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Machine Tool Operation, Part I
b. Kibbe, Machine Tool Practices
c. Porter, Machine Shop Operations and Setups

A/Vs:

a. Bergwall, "Bench Metal Work," filmstrip
b. Prentice-Hall, "Machine Shop: Bench Operations," filmstrip

Student Manuals:

Ohio, Machine Trades I, Bench Work Assignment Sheet #18

Tools and Equipment

a. Handtaps
b. Dies
c. Reamers
d. American Machinist's Handbook
e. Machinery's Handbook
f. Squares

LAB HOURS 4

CLASS HOURS 2

EVALUATION (MS-18)

a. Given a tap set and a hand die set, the student will tap threads in a hold and cut threads on a pipe or rod following appropriate procedures and all safety precautions.

b. V'TECS, Machine Shop, Task Nos. 57, 59 and 64.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

l. Chamfering a rod prior to threading
m. Lubrication
n. Major diameter and minor diameter
o. Safety

TASK

MS-19 Identifying power tool safety practices

PERFORMANCE OBJECTIVE

Identify safety procedures for using power tools in bench work.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Types of power tools
   1. Electrical
   2. Pneumatic
b. Electrical hazards
c. Mechanical hazards
d. Safety

Provide Demonstration On:

Safety rules for operating power drill, impact wrenches, power drivers and polishers

Provide Practical Application On:

Safety rules for operating power drills, impact wrenches, power drivers and polishers

INSTRUCTIONAL MATERIALS

Textbooks:

Dover, Tools and Their Uses

A/Vs:

Bergwall, "Working With Power Tools and Machines," filmstrip

Student Manuals:

Ohio, Machine Trades I, Bench Work Assignment Sheet #19

Tools and Equipment:

Safety posters

LAB HOURS	0
CLASS HOURS	2

EVALUATION (MS-19)

Given several power tools used in the machine shop, the student will identify electrical and mechanical hazards associated with tool usage and discuss related safety practices for each.

TASK

MS-20 Assembling and fitting

PERFORMANCE OBJECTIVE

Make drive, sliding, running and shrink fits for outside and inside measurements for gears, pulleys, bushings, shafts, spindles and threads.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Standard shafting
b. Tolerance
c. Precautions in making a press fit
d. Types/kinds of running fits
e. Shrink fit
f. Types of fits
    1. Loose fit
    2. Free fit
    3. Medium fit
    4. Snug fit
    5. Wringing fit
    6. Tight fit
    7. Medium fit
    8. Heavy force and shrink fit

Provide Demonstration On:

Making the following types of fits
a. Drive
b. Sliding
c. Running
d. Shrink

Provide Practical Application On:

Making the following types of fits
a. Drive
b. Slide
c. Running
d. Shrink

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Machine Tool Operation, Part I
b. Kibbe, Machine Tool Practices
c. Porter, Machine Shop Operations and Setups

A/Vs:

Bergwall, "Bench Metal Work," filmstrip

Student Manuals:

a. Ohio, Machine Trades I, Bench Work Assignment Sheet #20
b. Machine Shop Training Course, Vol. I

Tools and Equipment:

Machinery's Handbook

LAB HOURS 4
CLASS HOURS 2

EVALUATION (MS-20)

Given necessary tools and equipment, the student will make drive, sliding, running and shrink fits according to correct procedures.

TASK

MS-21 Identifying fasteners

PERFORMANCE OBJECTIVE

Identify fasteners.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Cut screw thread
b. Rolled screw thread
c. Screw thread inspection methods
d. Types of cuts on machine screws
e. Included angle of the standard V-thread
f. Purpose of an eye bolt
g. Allen set screws
h. Process of rolling a thread
i. Screw thread forms
j. Types of pins
k. Types of T-slot nuts
l. Types of washers
m. Types of screwheads
n. Types of screws
o. Studs

Provide Practical Application On:

Identifying various fasteners from a random selection

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Machine Tool Operation, Part I
b. Kibbe, Machine Tool Practices

A/Vs:

Prentice-Hall, "Working with Nuts and Bolts," filmstrip

Student Manuals:

a. Ohio, Machine Trades I, Bench Work Assignment Sheet #21
b. Machine Shop Training Course, Vol. I

Tools and Equipment:

a. American Machinist's Handbook
b. Commercial supply catalogs

(Continued on back)

LAB HOURS	2
CLASS HOURS	2

EVALUATION (MS-21)

Given a random selection of fasteners, the student will correctly identify each fastener and describe its application.

INSTRUCTIONAL MATERIALS

Tools and Equipment:

c. *Machinery's Handbook*
d. Selection of fasteners

TASK

MS-22 Using thread, center, fillet and radius gages

PERFORMANCE OBJECTIVE

Use the thread, center, fillet and radius gages.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Tolerance or allowance on threads
b. Methods of measuring screw threads
c. Wire methods of gaging threads
d. Screw thread micrometer
e. Types of threads
f. Fillet gage
g. Radius gage

Provide Demonstration On:

a. Using a screw thread micrometer
b. Using a fillet gage
c. Using a radius gage
d. Choosing a gage

Provide Practical Application On:

Choosing appropriate gage for an assigned measurement

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Machine Tool Operation, Part I
b. Kibbe, Machine Tool Practices
c. Porter, Machine Shop Operations and Setups

A/Vs:

Bergwall, "Measuring Tools Explained," filmstrip

Student Manuals:

a. Ohio, Machine Trades I, Bench Work Assignment Sheet #22
b. Machine Shop Training Course, Vol I

Tools and Equipment:

a. Thread gage
b. Fillet gage
c. Center gage

(Continued on back)

LAB HOURS	4
CLASS HOURS	2

EVALUATION (MS-22)

Given an assigned measurement and appropriate gages, the student will accurately choose the appropriate gage and make a measurement using either a thread, center, fillet or radius gage.

INSTRUCTIONAL MATERIALS

Tools and Equipment:

d. Radius gage
e. American Machinist's Handbook
f. Machinery's Handbook

TASK

MS-23 Identifying lubricants and greases

PERFORMANCE OBJECTIVE

Identify lubricants and greases.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Grease
b. Greasing devices
c. Lubricants used for vertically mounted motor
d. Lubricants used for horizontal motors
e. Viscosity
f. Bearing overheating factors
g. Lubrication systems
h. Drip and wick feeds

Provide Demonstration On:

Choosing a lubricant for a given application

Provide Practical Application On:

Choosing the appropriate lubricant for a given application

INSTRUCTIONAL MATERIALS

Textbooks:

Machinery's Handbook

A/Vs:

Bergwall, "The Lathe Explained," filmstrip

Student Manuals:

Ohio, Machine Trades I, Bench Work Assignment Sheet #23

Tools and Equipment:

Commercial supplier's catalogs

LAB HOURS	2
CLASS HOURS	2

EVALUATION (MS-23)

Given specifications for a machine which requires lubrication and a lubricant supplier's catalog, the student will choose the appropriate lubricant and method of lubrication.

TASK

MS-24 Performing machine maintenance

PERFORMANCE OBJECTIVE

Perform machine maintenance.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Responsibility for repairs in shop
b. Troubleshooting procedures
c. Using manufacturer's service manual
d. Safety in machine maintenance

Provide Demonstration On:

Troubleshooting shop machinery

Provide Practical Application On:

Troubleshooting a machine which is down and diagnose the problem

INSTRUCTIONAL MATERIALS

Textbooks:

Specific manufacturer's service manuals

A/Vs:

Prentice-Hall, "Machine Shop: Engine Lathe," filmstrip

Student Manuals:

Ohio, Machine Trades I, Bench Work Assignment Sheet #24

LAB HOURS	4
CLASS HOURS	2

EVALUATION (MS-24)

Given a machine which requires service and a manufacturer's service manual, the student will troubleshoot and diagnose the problem and identify the correct repair procedure.

TASK

MS-25 Identifying bench work safety

PERFORMANCE OBJECTIVE

Identify bench work safety.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Eye protection
b. Foot protection
c. Ear protection
d. Dust and hazardous fumes
e. Clothing, hair and jewelry
f. Hand protection
g. Lifting

Provide Demonstration On:

Identifying safety hazards in the shop

Provide Practical Application On:

Identifying safety hazards in the shop and recommend solutions

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Machine Tool Operation, Part I
b. Kibbe, Machine Tool Practices
c. Porter, Machine Shop Operations and Setups

A/Vs:

Bergwall, "Metal Shop Safety," filmstrip

Student Manuals:

Ohio, Machine Trades I, Bench Work Assignment Sheet #25

Tools and Equipment:

Safety goggles

LAB HOURS 0
CLASS HOURS 2

EVALUATION (MS-25)

Given a list of safety hazards in the shop, the student will accurately identify the hazards and recommend safe solutions.

TASK

MS-26 Identifying parts and functions of the drilling machine

PERFORMANCE OBJECTIVE

Identify parts and functions of the drilling machine.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Parts of the upright drill press
b. Purpose of the parts
c. Functions of the drill press
d. Safety

Provide Demonstrations On:

Operating a drill press

Provide Practical Application On:

Identifying the parts of the drill press and explaining what each part does

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, *Machine Tool Operation*, Part I
b. Kibbe, *Machine Tool Practices*
c. Porter, *Machine Shop Operations and Setups*

A/Vs:

Prentice-Hall, "Machine Shop: Drill Press," filmstrip

Student Manuals:

Ohio, *Machine Trades I*, Drilling Machine Work Assignment Sheet #1

Tools and Equipment:

Upright drill press

LAB HOURS 2

CLASS HOURS 2

EVALUATION (MS-26)

Given an upright drill press, the student will accurately identify each part and describe its function.

TASK

MS-27 Identifying safety practices and precautions when using the drilling machine

PERFORMANCE OBJECTIVE

Identify safety practices and precautions when using a drilling machine.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Using clamps
b. Broken bits
c. Turning workpiece due to "grabbing" drill bit
d. Keeping drill press table clean of tools
e. Lifting heavy pieces
f. Removing chuck key
g. Hand safety
h. Eye safety
i. Head safety

Provide Practical Application On:

Demonstrating safe drilling machine practices by selecting appropriate safety gear and by exhibiting a knowledge of safety procedures

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Machine Tool Operation, Part I
b. Kibbe, Machine Tool Practices
c. Porter, Machine Shop Operations and Setups

A/Vs:

Prentice-Hall, "Machine Shop: Drill Press," filmstrip

Student Manuals:

Ohio, Machine Trades I, Drilling Machine Works Assignment Sheet #2

Tools and Equipment:

a. Safety goggles or face shield
b. Safety hat

LAB HOURS	2
CLASS HOURS	2

EVALUATION (MS-27)

Given a drilling machine, the student will demonstrate correct safety precautions by choosing the appropriate safety gear and by demonstrating safe operating practices.

TASK

MS-28 Identifying work-holding devices and set ups

PERFORMANCE OBJECTIVE

Identify work-holding devices and set ups.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Purpose of work holding devices
b. Methods
    1. T-bolts and clamps
    2. Parallels
    3. C-clamps
    4. Angle plates
    5. Drill press vises
    6. Cold finished key stock
    7. Vee-blocks
c. Safety

Provide Demonstration On:

Using T-bolts and clamps to hold work down on the drill press

Provide Practical Application On:

a. Using T-bolts and clamps to hold work on the drill press
b. Identifying various types of drill press work holding devices

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Machine Tool Operation, Part I
b. Kibbe, Machine Tool Practices
c. Porter, Machine Shop Operations and Setups

A/Vs:

Prentice-Hall, "Machine Shop: Drill Press," filmstrip

Student Manuals:

Ohio, Machine Trades I, Drilling Machine Work Assignment Sheet #3

Tools and Equipment:

a. T-bolts
b. Clamps
c. Parallels
d. C-clamps
e. Angle plates
f. Drill press vises
g. Vee-blocks

LAB HOURS	2
CLASS HOURS	2

EVALUATION (MS-28)

Given a selection of drill press work-holding devices, the student will accurately identify each device. The student will locate and bolt down a workpiece on the press using T-bolts and clamps.

TASK

MS-29 Identifying and using drill bit holding devices

PERFORMANCE OBJECTIVE

Identify and use drill bit holding devices.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Drill chuck
b. Shank
c. Tang on tapered shanks
d. Drift or key
e. Drill bit holding devices
f. Safety

Provide Demonstration On:

Mounting a drill bit on the drilling machine

Provide Practical Application On:

Mounting a drill bit on the drilling machine

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Machine Tool Operation, Part I
b. Kibbe, Machine Tool Practices
c. Porter, Machine Shop Operations and Setups

A/Vs:

Prentice-Hall, "Machine Shop: Drill Press," filmstrip

Student Manuals:

Ohio, Machine Trades I, Drilling Machine Work Assignment Sheet #4

Tools and Equipment:

a. Drill bit
b. Drilling machine
c. Chuck

LAB HOURS	2
CLASS HOURS	2

EVALUATION (MS-29)

a. Given a drilling machine, drill bit and chuck, the student will accurately follow procedures to accurately mount a drill bit on the drilling machine.

b. V'TECS, Machine Shop, Task No. 62.

TASK

MS-30 Identifying drill bits

PERFORMANCE OBJECTIVE

Identify drill bits.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Four parts of a twist drill bit
b. Types of shanks
c. Purpose of flutes
d. Sizes of twist drills
e. Checking a drill for correct size
f. Using an oil hole drill
g. Lip angle
h. Purpose of tang
i. RPM, FPM

Provide Demonstration On:

Checking a drill for correct size for a given job

Provide Practical Application On:

Checking a drill for correct size for a given job

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Machine Tool Operation, Part I
b. Kibbe, Machine Tool Practices
c. Porter, Machine Shop Operations and Setups

Studnet Manuals:

Ohio, Machine Trades I, Drilling Machine Work Assignment Sheet #5

Tools and Equipment:

a. Twist drill bits
b. Drill gage

LAB HOURS	1
CLASS HOURS	2

EVALUATION (MS-30)

Given specifications for a job, a drill gage and a selection of twist drill bits, the student will accurately select the correct size twist drill for the job.

TASK

MS-31 Identifying cutting feeds and speeds

PERFORMANCE OBJECTIVE

Identifying cutting feeds and speeds.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Types of steel used for twist drills
b. Identifying the high speed drill
c. Setting the speed on a high speed drill 4 x cutting speed ÷ drill diameter
d. The feed of a drill
e. FPM
f. RPM

Provide Demonstration On:

a. Figuring the cutting speed of a given drill
b. Figuring feed

Provide Practical Application On:

a. Figuring the cutting speed of a drill
b. Figuring the cutting feed of a drill

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Machine Tool Operation, Part I
b. Kibbe, Machine Tool Practices
c. Porter, Machine Shop Operations and Setups

Student Manuals:

Ohio, Machine Trades I, Drilling Machine Work Assignment Sheet #6

Tools and Equipment:

a. Drill bits
b. Drilling machine
c. Assigned job

LAB HOURS	2
CLASS HOURS	2

EVALUATION (MS-31)

a. Given all appropriate tools, supplies and equipment, the student will accurately calculate the feed (in FPM) and speed (in RPM) of a H.S. twist drill for a specific job.

b. V'TECS, Machine Shop, Task No. 64.

TASK

MS-32 Identifying principles of straight drilling

PERFORMANCE OBJECTIVE

Identify principles of straight drilling.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Drilling
b. Pilot or bad hole
c. Scribing a circle in the workpiece
d. Calculating and setting speed and feeds
e. Feeding by hand
f. Chipped tips
g. Drawing or pulling a hole
h. Drilling brass

Provide Demonstration On:

Using the drilling machine to perform straight drilling

Provide Practical Application On:

Drilling straight through an assigned workpiece

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, *Machine Tool Operation* (Part I)
b. Kibbe, *Machine Tool Practices*
c. Porter, *Machine Shop Operations and Setups*

A/Vs:

a. Bergwall, "Bench Metalwork," filmstrip
b. Prentice-Hall, "Machine Shop: Drill Press," filmstrip

Student Manuals:

Ohio, *Machine Trades I*, Drilling Machine Work Assignment Sheet #7

Tools and Equipment:

a. Drill press
b. Twist drill bits
c. Assigned workpiece

LAB HOURS	2
CLASS HOURS	2

EVALUATION (MS-32)

a. Given an assigned workpiece, the student will accurately secure the piece on the drill press, select a drill bit, calculate feed and speed and drill straight through the piece observing all safety precautions.

b. V'TECS, Machine Shop, Task No. 56.

TASK

MS-33 Identifying and using coolants and cutting compounds

PERFORMANCE OBJECTIVE

Identify and use coolants and cutting compounds.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Cutting oils
b. Cutting compounds
c. Advantages of using oils and compounds
d. Using terpentine
e. Oil tube drill
f. Reclaiming cutting oils
g. Selecting coolant foumula
h. Using a cutting compound
i. Cutting compounds for cast iron
j. Cutting compounds for brass

Provide Demonstration On:

a. Selecting a coolant formula
b. Using a cutting compound

Provide Practical Application On:

a. Selecting a coolant formula for a given job
b. Using a cutting compound

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Machine Tool Operation (Part I)
b. Kibbe, Machine Tool Practices
c. Porter, Machine Shop Operations and Setups

A/Vs:

a. Bergwall, "Bench Metalwork," filmstrip
b. Prentice-Hall, "Machine Shop: Drill Press," filmstrip

Student Manuals:

Ohio, Machine Trades I, Drilling Machine Work Assignment Sheet #8

Tools and Equipment:

a. Machinery's Handbook
b. American Machinist's Handbook

LAB HOURS	2
CLASS HOURS	2

EVALUATION (MS-33)

Given a specified job, the student will accurately select the appropriate cutting lubricant or compound and drill the stock according to appropriate safe procedures.

TASK

MS-34 Grinding and caring of drills

PERFORMANCE OBJECTIVE

Identify and observe proper care and use of drills and correctly grind a drill bit.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Parts of a drill bit
b. Grinding the web of a drill bit (proper web size)
c. Lip angles
d. Lip clearance angle
e. Causes of over-size drilled holes
f. Other drill clearances
g. Measuring the drill bit size

Provide Demonstration On:

Grinding the web of a drill bit to proper web size

Provide Practical Application On:

Grinding the web of a drill bit to proper web size

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, *Machine Tool Operation* (Part I)
b. Kibbe, *Machine Tool Practices*
c. Porter, *Machine Shop Operations and Setups*

A/Vs:

a. Bergwall, "Bench Metalwork," filmstrip
b. Prentice-Hall, "Machine Shop: Drill Press," filmstrip

Student Manuals:

Ohio, *Machine Trades I*, Drilling Machine Work Assignment Sheet #9

Tools and Equipment:

a. Drill bits
b. Emery wheel
c. Twist drill gage
d. *Machinery's Handbook*
e. *Handbook for Drillers*

LAB HOURS	2
CLASS HOURS	2

EVALUATION (MS-34)

a. Given a drill bit and an emery wheel, the student will accurately grind the web of the bit to proper size.

b. V'TECS, Machine Shop, Task No. 59.

TASK

MS-35 Identifying and using twist drill gages

PERFORMANCE OBJECTIVE

Identify and use twist drill gages.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Twist drill gage
b. Drill point gage
c. Universal drill grinding gage
d. Reading the twist drill gage
e. Reading the drill point gage

Provide Demonstration On:

a. Using the twist drill gage
b. Using the drill point gage

Provide Practical Application On:

a. Using the twist drill gage and checking a twist drill for size
b. Using the drill point gage and checking the angle of the point

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Machine Tool Operation (Part I)
b. Kibbe, Machine Tool Practices
c. Porter, Machine Shop Operations and Setups

A/Vs:

a. Bergwall, "Bench Metalwork," filmstrip
b. Prentice-Hall, "Machine Shop: Drill Press," filmstrip

Student Manuals:

Ohio, Machine Trades I, Drilling Machine Work Assignment Sheet #10

Tools and Equipment:

a. Twist drill gage
b. Drill point gage
c. Twist drill

LAB HOURS	2
CLASS HOURS	2

EVALUATION (MS-35)

Given a twist drill gage and a drill point gage, the student will accurately measure several drills for point angle and size.

TASK

MS-36 Identifying and using drill grinding machines

PERFORMANCE OBJECTIVE

Identify and use drill grinding machines.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Drill grinding machines
   1. Types
   2. Applications
b. Hand grinding
c. Advantages of machine grinding
d. Adapting a regular pedestal grinder
e. Safety

Provide Demonstration On:

Using the drill grinder to correctly grind a drill

Provide Practical Application On:

Grinding a drill on the drill grinder to proper size and point angle

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, *Machine Tool Operation* (Part I)
b. Kibbe, *Machine Tool Practices*
c. Porter, *Machine Shop Operations and Setups*

A/Vs:

a. Bergwall, "Bench Metalwork," filmstrip
b. Prentice-Hall, "Machine Shop: Drill Press," filmstrip

Student Manuals:

Ohio, *Machine Trades I*, Drilling Machine Work Assignment Sheet #11

Tools and Equipment:

a. Drill grinding machine
b. Drill gage
c. Drill point gage
d. Twist drills
e. Safety glasses

LAB HOURS 2

CLASS HOURS 2

EVALUATION (MS-36)

a. Given a drill grinding machine, drill gage, point gage and twist drill, the student will accurately grind the drill bit to proper size and point angle observing all safety precautions.

b. V'TECS, Machine Shop, Task No. 59.

TASK

MS-37 Identifying machine reamers

PERFORMANCE OBJECTIVE

Identify machine reamers.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Types of machine reamers
b. Purpose of a taper reamer
c. Expansion reamer
d. Shell reamer
e. Rose reamer (parts of)
f. Carbide tipped reamers
g. Spiral fluted reamer
h. Method of holding taper shank reamer
i. Method of holding straight shank reamer
j. Storage of reamers
k. Safety

Provide Demonstration On:

Selecting of a reamer for a job

Provide Practical Application On:

Selecting a reamer for a specific job

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Machine Tool Operation (Part I)
b. Kibbe, Machine Tool Practices
c. Porter, Machine Shop Operations and Setups

A/Vs:

a. Bergwall, "Bench Metalwork," filmstrip
b. Prentice-Hall, "Machine Shop: Drill Press," filmstrip

Student Manuals:

Ohio, Machine Trades I, Drilling Machine Work Assignment Sheet #12

Tools and Equipment:

Various types of reamers

LAB HOURS	1
CLASS HOURS	2

EVALUATION (MS-37)

a. Given specifications for a job, the student will accurately select the best reamer for the job.

b. V'TECS, Machine Shop, Task No. 58.

TASK

MS-38 Performing machine reaming with the drilling machine

PERFORMANCE OBJECTIVE

Perform machine reaming with the drilling machine.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Figuring reaming feed and speed
b. Using cutting oils and compounds for reaming
c. Purpose of reaming
d. Classifying reamers
e. Hand reaming vs machine reaming
f. Reamer safety

Provide Demonstration On:

a. Calculating reaming feed and speed for a specific job
b. Reaming procedure

Provide Practical Application On:

a. Calculating feed and speed for a reaming job
b. Using a reamer to ream four 7/8" holes

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Machine Tool Operation (Part I)
b. Kibbe, Machine Tool Practices
c. Porter, Machine Shop Operations and Setups

A/Vs:

a. Bergwall, "Bench Metalwork," filmstrip
b. Prentice-Hall, "Machine Shop: Drill Press," filmstrip

Student Manuals:

Ohio, Machine Trades I, Drilling Machine Work Assignment Sheet #13

Tools and Equipment:

a. Drilling machine
b. Reamers
c. Safety glasses
d. Machinery's Handbook
e. American Machinist's Handbook

LAB HOURS	2
CLASS HOURS	2

EVALUATION (MS-38)

a. Given a reaming job, the student will select the appropriate reamer, calculate speed and feed and accurately ream four 7/8 inch holes according to the instructor's specifications.

b. V'TECS, Machine Shop, Task No. 58.

TASK

MS-39 Identifying principles of boring and counterboring

PERFORMANCE OBJECTIVE

Identify principles of boring and counterboring.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Difference between boring and counterboring
b. Boring vs reaming
c. Procedure for producing a straight and accurate hole
d. Adjustable single-point boring tool
e. Types of counterbores
f. Parts of the counterbore
g. Purpose of the guide or pilot on the counterbore
h. Removable blade counterbore vs solid counterbore
i. Safety

Provide Demonstration On:

a. Procedures for producing a straight and accurate hole
b. Boring a hole
c. Counterboring a hole

Provide Practical Application On:

a. Boring a hole
b. Counterboring a hole

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Machine Tool Operation (Part I)
b. Kibbe, Machine Tool Practices
c. Porter, Machine Shop Operations and Setups

A/Vs:

Prentice-Hall, "Machine Shop: Drill Press," filmstrip

Student Manuals:

Ohio, Machine Trades I, Drilling Machine Work Assignment Sheet #14

Tools and Equipment:

a. Machinery's Handbook
b. American Machinist's Handbook
c. Drilling machine
d. Bore
e. Counterbore
f. Safety glasses

LAB HOURS 1

CLASS HOURS 2

EVALUATION (MS-39)

a. Given appropriate tools, supplies and equipment, the student will bore and counterbore holes which are straight and accurate.

b. V'TECS, Machine Shop, Task No. 53.

TASK

MS-40 Using the drill press in spot facing operations

PERFORMANCE OBJECTIVE

Use the drill press in spot facing operations.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Spot facing (purpose)
b. Spot facing tool
c. Spot facing vs counterboring
d. Spot facing cast iron
e. Spot facing speeds/feeds
f. Safety

Provide Demonstration On:

Procedures for spot facing

Provide Practical Application On:

Spot facing a piece of material which has been drilled according to given specifications

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Machine Tool Operation (Part I)
b. Kibbe, Machine Tool Practices
c. Porter, Machine Shop Operations and Setups

A/Vs:

Prentice-Hall, "Machine Shop: Drill Press, " filmstrip

Student Manuals:

Ohio, Machine Trades I, Drilling Machine Work Assignment Sheet #15

Tools and Equipment:

a. Drilling machine
b. Spot facing tool
c. Pre-drilled metal stock
d. Safety glasses

LAB HOURS 2

CLASS HOURS 2

EVALUATION (MS-40)

a. Given a drilling machine and all necessary tools and supplies, the student will accurately spot face a pre-drilled piece of material to given specifications.

b. V"TECS, Machine Shop, Task No. 65.

TASK

MS-41 Performing counter sinking and center drilling operations

PERFORMANCE OBJECTIVE

Perform counter sinking and center drilling operations.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Counter boxing vs counter sinking
b. Purpose of counter sinking
c. Counter sinking angles
d. Causes of chattering (prevention)
e. Center drilling vs counter sinking
f. Angle of center drill
g. Safety

Provide Demonstration On:

a. Procedures for counter sinking
b. Procedures for center drilling

Provide Practical Application On:

a. Counter sinking a work piece
b. Center drilling a work piece

INSTRUCTIONAL MATERIALS

a. Burghardt, Machine Tool Operation (Part I)
b. Kibbe, Machine Tool Practices
c. Porter, Machine Shop Operations and Setups

A/Vs:

Prentice-Hall, "Machine Shop: Drill Press," filmstrip

Student Manuals:

Ohio, Machine Trades I, Drilling Machine Work Assignment Sheet #16

Tools and Equipment:

a. Machinery's Handbook
b. Drilling machine
c. Counter sinking tool
d. Center drilling tool
e. Safety glasses

LAB HOURS	4
CLASS HOURS	2

EVALUATION (MS-41)

a. Given all necessary tools and equipment, the student will accurately counter sink a work piece to given specifications.

b. Given all necessary tools and equipment, the student will accurately center drill a work piece to given specifications.

c. V'TECS, Machine Shop, Task No. 54.

TASK

MS-42 Identifying lathe safety

PERFORMANCE OBJECTIVE

Identify lathe safety.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Importance of safety
b. Hazards
    1. Long sleeves
    2. Rings, watches, etc.
    3. Files without handles
    4. Pinch points
    5. High temperature components
    6. Sharp edges
c. Safety practices
d. Personal protection gear
e. Housekeeping

Provide Demonstration On:

Proper filing technique in the lathe

Provide Practical Application On:

Listing six hazards in lathe operation and how to avoid them

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Machine Tool Operation (Part I)
b. Kibbe, Machine Tool Practices
c. Porter, Machine Shop Operations and Setups

A/Vs:

Bergwall, "Metal Shop Safety," filmstrip

Student Manuals:

Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #1

LAB HOURS	0
CLASS HOURS	2

EVALUATION (MS-42)

Given an overview of lathe safety practices, the student will correctly list at least six safety hazards in lathe operation and their associated safety precautions.

TASK

MS-43 Identifying lathes

PERFORMANCE OBJECTIVE

Identify lathes.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Brief history of automation in industry
b. The lathe
   1. Determining engine size
   2. Three basic types
   3. Purpose of various sizes
   4. Purpose of head-stock
   5. Standard vs quick change geared
   6. "Live center" vs "dead center"
   7. Operations which can be performed on a lathe
   8. Gages and how they are used

Provide Practical Application On:

a. Identifying and describing the purpose of the parts of a lathe on a diagram
b. Listing the operations which can be performed on a lathe

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Machine Tool Operation (Part I)
b. Kibbe, Machine Tool Practices
c. Porter, Machine Shop Operations and Setups

A/Vs:

a. Bergwall, "The Lathe Explained," filmstrip
b. Prentice-Hall, "Machine Shop: Drill Press," filmstrip

Student Manuals:

Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #1

Tools and Equipment:

Diagram of a lathe

LAB HOURS	0
CLASS HOURS	2

EVALUATION (MS-43)

Given a diagram of a lathe, the student will accurately identify each part, describe its use and list at least five operations which can be performed on it.

TASK

MS-44 Identifying work-holding devices

PERFORMANCE OBJECTIVE

Identify work-holding devices.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Lathe spindle nose
b. Chucks
c. Drive plates
d. Faceplates
e. Collets
f. Centering accuracy of various chucks

Provide Practical Application On:

Identifying several types of chucks in the lab

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Machine Tool Operation, Part I
b. Kibbe, Machine Tool Practices
c. Porter, Machine Shop Operations and Setups

A/Vs:

a. Bergwall, "The Lathe Explained," filmstrip
b. Prentice-Hall, "Machine Shop: Engine Lathe," filmstrip

Student Manuals:

Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #3

Tools and Equipment:

Several types of chucks

LAB HOURS	1
CLASS HOURS	2

EVALUATION (MS-44)

a. Given a selection of lathe work-holding devices, the student will identify each type of chuck and describe its relative accuracy according to the instructor's satisfaction.

b. V'TECS, Machine Shop, Task No. 110.

TASK

MS-45 Identifying cutting tools

PERFORMANCE OBJECTIVE

Identify cutting tools.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Cutting tools
b. Geometric form of lathe tools
c. Tool grinding
d. Tool holder
e. Tool holder with back rake
f. Cutting angles
g. Chip safety (chip breakers)
h. Heat hazards

Provide Demonstration On:

a. Grinding a lathe tool
b. Choosing a tool

Provide Practical Application On:

Choosing a tool for a specified job and grind the tool to proper shape and dimensions

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Machine Tool Operation, Part I
b. Kibbe, Machine Tool Practices
c. Porter, Machine Shop Operations and Setups

A/Vs:

a. Bergwall, "The Lathe Explained," filmstrip
b. Prentice-Hall, "Machine Shop: Engine Lathe," filmstrip

Student Manuals:

a. Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #4 and #5
b. Machine Shop Training Course, Vol. I

Tools and Equipment:

a. Grinding wheel
b. Lathe tools

LAB HOURS 1
CLASS HOURS 2

EVALUATION (MS-45)

Given specifications for a lathe operation, the student will correctly choose the appropriate tool for the job and follow correct procedures in grinding the tool to shape for use on the lathe.

TASK

MS-46 Identifying measuring tools

PERFORMANCE OBJECTIVE

Identify measuring tools.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Calipers
b. Micrometer
c. Snap and plug gages
d. Steel rules
e. Depth gages
f. Safety

Provide Demonstration On:

Using the following to make measurements
a. Calipers
b. Micrometer
c. Snap and plug gages
d. Steel rules
e. Depth gages

Provide Practical Application On:

Using the following instruments to make assigned measurements
a. Calipers
b. Micrometer
c. Snap and plug gages
d. Steel rules
e. Depth gage

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Machine Tool Operation, Part I
b. Kibbe, Machine Tool Practices
c. Porter, Machine Shop Operations and Setups

A/Vs:

Bergwall, "Measuring Tools," filmstrip

Student Manuals:

a. Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #6
b. Machine Shop Training Course, Vol. I

Tools and Equipment:

a. Calipers (inside and outside)
b. Micrometer

(Continued on back)

LAB HOURS	1
CLASS HOURS	2

EVALUATION (MS-46)

Given assigned objects to measure, the student will follow correct procedures and use the following tools to make measurements

a. Calipers
b. Micrometer
c. Snap and plug gages
d. Steel ruler
e. Depth gages

INSTRUCTIONAL MATERIALS

Tools and Equipment:

d. Steel rules
e. Depth gage

TASK

MS-47 Identifying lathe attachments

PERFORMANCE OBJECTIVE

Identify lathe attachments.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Center rest
b. Turning long, slim work
c. Follower rest
d. Taper attachment

Provide Demonstration On:

Mounting the following on a lathe
a. Center rest
b. Follower rest
c. Taper attachment

Provide Practical Application On:

Identifying various types of lathe attachments in the lab and mounting the following on the lathe
a. Center rest
b. Follower rest
c. Taper attachment

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Machine Tool Operation, Part I
b. Kibbe, Machine Tool Practices and Machine Shop Operations and Setups

A/Vs:

a. Bergwall, "The Lathe Explained," filmstrip
b. Prentice-Hall, "Machine Shop: Engine Lathe," filmstrip

Student Manuals:

Ohio, Machine Trades I, Engine Lathe Work, Assignment Sheet #7

Tools and Equipment:

a. Center rest
b. Follower rest
c. Taper attachment
d. Lathe
e. Hand tools

LAB HOURS	2
CLASS HOURS	2

EVALUATION (MS-47)

Given appropriate tools, supplies and equipment, the student will mount and describe the use of the center rest, follower rest and taper attachment.

TASK

MS-48 Calculating cutting feeds and speeds on the lathe

PERFORMANCE OBJECTIVE

Calculate cutting feeds and speeds on the lathe.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Cutting speed formula
b. Feed
c. Cutting speed
d. Formula for circumference of a circle
e. Variance in cutting speed
f. Figuring feed

Provide Demonstration On:

a. Figuring cutting speed
b. Figuring feed

Provide Practical Application On:

Figuring cutting speed and feed for a specified job

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Machine Tool Operation, Part I
b. Kibbe, Machine Tool Practices
c. Porter, Machine Shop Operations and Setups

A/Vs:

a. Bergwall, "The Lathe Explained," filmstrip
b. Prentice-Hall, "Machine Shop: Engine Lathe," filmstrip

Student Manuals:

a. Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #8
b. Machine Shop Training Course

Tools and Equipment:

a. Lathe
b. Cutting tool
c. Workpiece

LAB HOURS	2
CLASS HOURS	2

EVALUATION (MS-48)

Given specifications for a job and necessary tools, supplies and equipment, the student will calculate the necessary feed and speed required to complete the job.

TASK

MS-49 Determining RPM

PERFORMANCE OBJECTIVE

Determine RPM.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Formula for figuring RPM of a lathe
b. Calculating the formula given cutting speed, rim speed or surface speed

Provide Demonstration On:

Calculating lathe RPM given cutting speed, rim speed or surface speed

Provide Practical Application On:

Working lathe RPM problems

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Machine Tool Operation, Part I
b. Kibbe, Machine Tool Practices
c. Porter, Machine Shop Operations and Setups

A/Vs:

a. Bergwall, "The Lathe Explained," filmstrip
b. Prentice-Hall, "Machine Shop: Engine Lathe," filmstrip

Student Manuals:

a. Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #9
b. Machine Shop Training Course, Vol. I

LAB HOURS	2
CLASS HOURS	2

EVALUATION (MS-49)

a. Given a known cutting speed, rim speed or surface speed, the student will accurately calculate lathe RPM.

b. V'TECS, Machine Shop, Task No. 109.

TASK

MS-50 Centering stock

PERFORMANCE OBJECTIVE

Center stock.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Reason for various sizes of combination center drills
b. Methods of locating center holes
c. Standard angle for center holes
d. Square-facing the work
e. Testing the work for trueness
f. Finding centers of irregularly shaped work

Provide Demonstration On:

a. Centering a piece of work on a lathe
b. Testing for trueness

Provide Practical Application On:

Squaring and centering a piece of work on a lathe

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Machine Tool Operation, Part I
b. Kibbe, Machine Tool Practices
c. Porter, Machine Shop Operations and Setups

A/Vs:

a. Bergwall, "The Lathe Explained," filmstrip
b. Prentice-Hall, "Machine Shop: Engine Lathe," filmstrip

Student Manuals:

a. Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #10
b. Machine Shop Training Course, Vol. I

Tools and Equipment:

a. Lathe
b. Workpiece
c. Test bar and dial indicators
d. Centering tools

LAB HOURS	2
CLASS HOURS	2

EVALUATION (MS-50)

a. Given a specified job and necessary tools and equipment, the student will center the stock correctly on the engine lathe and check for accuracy of alignment.

b. V'TECS, Machine Shop, Task Nos. 85 and 86.

TASK

MS-51 Identifying principles of facing

PERFORMANCE OBJECTIVE

Identify principles of facing.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Facing
b. Leaving work longer than finished size
c. Right-cut facing tool
d. Half-center
e. Measuring
    1. Steel rule
    2. Vernier caliper
    3. Large micrometer

Provide Demonstration On:

Facing a workpiece

Provide Practical Application On:

Facing a workpiece to specified dimensions

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Machine Tool Operation, Part I
b. Kibbe, Machine Tool Practices
c. Porter, Machine Shop Operations and Setups

A/Vs:

a. Bergwall, "The Lathe Explained," filmstrip
b. Prentice-Hall, "Machine Shop: Engine Lathe," filmstrip

Student Manuals:

a. Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #11
b. Machine Shop Training Course, Vol. I

Tools and Equipment:

a. Lathe
b. Cutting tool
c. Workpiece
d. Steel rules

LAB HOURS	1
CLASS HOURS	2

EVALUATION (MS-51)

a. Given necessary tools, equipment and specifications, the student will face a workpiece in accordance with the instructor's requirements.

b. V'TECS, Machine Shop, Task No. 98.

TASK

MS-52 Identifying principles of straight turning and turning to shoulders

PERFORMANCE OBJECTIVE

Identify principles of straight turning and turning to shoulders.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Rough turning
    1. Tolerance
    2. Setting the compound
    3. Tool-holder
    4. Safety
    5. Making a trial cut to true up the piece
    6. Lubricating the tail center
b. Finish turning
    1. Selection of cutting tool
    2. Using the micrometer
    3. Safety

(Continued on back)

Provide Demonstration On:

a. Rough turning a piece
b. Finish turning
c. Turning a shoulder

Provide Practical Application On:

a. Performing straight turning on a piece
b. Performing shoulder turning on a piece

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Machine Tool Operation, Part I
b. Kibbe, Machine Tool Practices
c. Porter, Machine Shop Operations and Setups

A/Vs:

a. Bergwall, "The Lathe Explained," filmstrip
b. Prentice-Hall, "Machine Shop: Engine Lathe," filmstrip

Student Manuals:

a. Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #12
b. Machine Shop Training Course, Vol. I

LAB HOURS	2
CLASS HOURS	2

EVALUATION (MS-52)

a. Given appropriate tools, supplies and materials, the student will accurately perform turning operations including straight turning and turning to shoulder.

b. V'TECS, Machine Shop, Task No. 100.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

c. Turning to shoulder
    1. Machining a piece to several different diameters
    2. Square shoulder
    3. Angular shoulder
    4. Filleted shoulder
    5. Undercut shoulder
    6. Using the fillet or radius gage

TASK

MS-53 Identifying chucks

PERFORMANCE OBJECTIVE

Identify chucks.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Purpose of a chuck
b. Common types of chucks
    1. Three-jaw universal
    2. Four-jaw independent
    3. Jacobs chuck
    4. Draw-in collet chuck
c. Selecting chuck jaws
d. Mounting and removing chucks
e. Safety
f. Storage of chucks

Provide Demonstration On:

a. Selecting chuck jaws and installing them
b. Mounting and removing chucks

Provide Practical Application On:

a. Selecting chuck jaws and installing them
b. Mounting and removing chucks from a lathe

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Machine Tool Operation, Part I
b. Kibbe, Machine Tool Practices
c. Porter, Machine Shop Operations and Setups

A/Vs:

a. Bergwall, "The Lathe Explained," filmstrip
b. Prentice-Hall, "Machine Shop: Engine Lathe," filmstrip

Student Manuals:

a. Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #13
b. Machine Shop Training Course, Vol. I

Tools and Equipment:

a. Lathe
b. Handtools
c. Chucks and jaws
d. Wooden board

LAB HOURS 2

CLASS HOURS 2

EVALUATION (MS-53)

Given a specified job, the student will accurately select a chuck, mount the jaws and remove the chuck from the lathe.

TASK

MS-54 Performing form turning operations

PERFORMANCE OBJECTIVE

Perform form turning operations.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Free-hand form turning
b. Eye-hand coordination
c. Form turning with a tool ground to the desired shape
d. Operating controls for form turning
e. Tape operated machines
f. Spring tool
g. Setting the cutting speed

Provide Demonstration On:

Form turning on a lathe

Provide Practical Application On:

Form turning a specified shape on a lathe

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Machine Tool Operation, Part I
b. Kibbe, Machine Tool Practices

A/Vs:

a. Bergwall, "The Lathe Explained," filmstrip
b. Prentice-Hall, "Machine Shop: Engine Lathe," filmstrip

Student Manuals:

a. Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #15
b. Machine Shop Training Course, Vol. I

Tools and Equipment:

a. Lathe
b. Workpiece
c. Hand tools
d. Cutting tools

LAB HOURS	10
CLASS HOURS	5

EVALUATION (MS-54)

Given appropriate tools, supplies, equipment and specifications, the student will form turn a workpiece to a shape specified by the instructor.

TASK

MS-55 Identifying principles of faceplate work

PERFORMANCE OBJECTIVE

Identify principles of faceplate work.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Accessories used for faceplate work
    1. End measuring rod
    2. Square head bolt
    3. Faceplate
    4. U-clamp
    5. Parallel
    6. Parallel strip
    7. Angle plate
    8. Stop block

b. Classes of work which are machined on a faceplate

c. Trueing-up work on a faceplate

d. Counterbalancing

e. Clamping the work

Provide Demonstration On:

Mounting a workpiece on a faceplate using T-bolts and strap clamps

Provide Practical Application On:

Mounting a workpiece on a faceplate using T-bolts and strap clamps

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Machine Tool Operation, Part I

b. Kibbe, Machine Tool Practices

c. Porter, Machine Shop Operations and Setups

A/Vs:

a. Bergwall, "The Lathe Explained," filmstrip

b. Prentice-Hall, "Machine Shop: Engine Lathe," filmstrip

Student Manuals:

a. Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #16

b. Machine Shop Training Course, Vol. I

Tools and Equipment:

a. Lathe with faceplate

b. T-bolts

c. Strap clamps

d. Wrenches

LAB HOURS 2

CLASS HOURS 2

EVALUATION (MS-55)

a. Given necessary tools, supplies and equipment, the student will mount a workpiece on a faceplate using T-bolts and strap clamps.

b. V'TECS, Machine Shop, Task No. 98.

TASK

MS-56 Using draw-in collets

PERFORMANCE OBJECTIVE

Use draw-in collets.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Advantages of draw-in collets
b. How collets are held in a lathe
c. Classes of work held in collets
d. Advantages of a hollow draw bar
e. Securing the collet in the collet sleeve
f. Collet safety

Provide Demonstration On:

Installing collets on the lathe

Provide Practical Application On:

Installing a collet on a lathe

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Machine Tool Operation, Part I
b. Kibbe, Machine Tool Practices
c. Porter, Machine Shop Operations and Setups

A/Vs:

a. Bergwall, "The Lathe Explained," filmstrip
b. Prentice-Hall, "Machine Shop: Engine Lathe," filmstrip

Student Manuals:

a. Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #17
b. Machine Shop Training Course, Vol. I

Tools and Equipment:

a. Lathe
b. Collet chuck
c. Wrenches

LAB HOURS 5

CLASS HOURS 5

EVALUATION (MS-56)

Given appropriate tools and equipment, the student will install a collet chuck on a lathe. The student must follow correct procedures and safety precautions in making the installation.

TASK

MS-57 Identifying principles of drilling

PERFORMANCE OBJECTIVE

Identify principles of drilling.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Mounting work for drilling
b. Pilot drilling
c. Lathe dog
d. Alignment
e. Necessity for reaming
f. Safety

Provide Demonstration On:

a. Mounting a straight shank drill in a drill chuck
b. Mounting workpiece
c. Drilling a workpiece

Provide Practical Application On:

Mounting a drill in a chuck, mounting assigned work and drilling to given specifications

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Machine Tool Operation, Part I
b. Kibbe, Machine Tool Practices
c. Porter, Machine Shop Operations and Setups

A/Vs:

Bergwall, "Bench Metalwork," filmstrip

Student Manuals:

a. Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #18
b. Machine Shop Training Course, Vol. I

Tools and Equipment:

a. Lathe
b. Drill
c. Drill chuck
d. Collet or faceplate

(Continued on back)

LAB HOURS 2

CLASS HOURS 2

EVALUATION (MS-57)

a. Given necessary tools, equipment and specifications, the student will drill a workpiece to specified dimensions.

b. V'TECS, Machine Shop, Task No. 97.

INSTRUCTIONAL MATERIALS

Tools and Equipment:

e. Tools
f. Lathe dog (for larger drills)
g. Safety goggles

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TASK

MS-58 Identifying machine reamers

PERFORMANCE OBJECTIVE

Identify machine reamers.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Types of reamers
b. Adjustable reamer
c. Shell reamer
d. Flutes of the reamer
e. Advantages of spiral flutes
f. Chucking reamer
g. Parts of a reamer

Provide Demonstration On:

a. Identifying parts of a reamer
b. Identifying types of reamers

Provide Practical Application On:

a. Identifying the parts of a reamer (six)
b. Identifying types of reamers

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Machine Tool Operation, Part I
b. Kibbe, Machine Tool Practices
c. Porter, Machine Shop Operations and Setups

A/Vs:

Bergwall, "Bench Metalwork," filmstrip

Student Manuals:

a. Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #19
b. Machine Shop Training Course, Vol. I

Tools and Equipment:

Reamers

LAB HOURS	2
CLASS HOURS	2

EVALUATION (MS-58)

Given a selection of reamers, the student will correctly identify the type of reamer and correctly name its six basic parts.

TASK

MS-59 Performing reaming operations on the engine lathe

PERFORMANCE OBJECTIVE

Perform reaming operations on the engine lathe.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Purpose of reaming
b. How a reamer is held on the lathe
c. Calculating speeds and feeds for reaming
d. Lubricants for reaming
e. Small machine reamers
f. Alighment
g. Safety

Provide Demonstration On:

a. Mounting a reamer on the lathe
b. Reaming on the lathe

Provide Practical Application On:

Mounting a reamer on a lathe and reaming a hole in a predrilled workpiece

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, *Machine Tool Operation, Part I*
b. Kibbe, *Machine Tool Practices*
c. Porter, *Machine Shop Operations and Setups*

A/Vs:

Bergwall, "Bench Metalwork," filmstrip

Student Manuals:

a. Ohio, *Machine Trades I*, Engine *Lathe Work Assignment Sheet #20*
b. *Machine Shop Training Course*, Vol. I

Tools and Equipment:

a. Reamers
b. Lathe
c. Workpiece
d. Tools
e. Safety goggles

LAB HOURS 5

CLASS HOURS 2

EVALUATION (MS-59)

a. Given a lathe, reamers, pre-drilled workpiece and specifications, the student will mount a reamer on the lathe and correctly ream the drilled holes on the workpiece.

b. V'TECS, Machine Shop, Task No. 104.

TASK

MS-60 Performing boring operations on the engine lathe

PERFORMANCE OBJECTIVE

Perform boring operations on the engine lathe.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Boring
b. Methods of boring
c. Why a drilled hole must be bored
d. Forged boring tool
e. Boring bar holder
f. Measuring tools
g. Chatter and vibration
h. Through-boring
i. Thread-relief
j. Safety

Provide Demonstration On:

Boring a drilled hole

Provide Practical Application On:

Boring a drilled hole to specified dimensions

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Machine Tool Operation, Part I
b. Kibbe, Machine Tool Practices
c. Porter, Machine Shop Operations and Setups

A/Vs:

a. Bergwall, "Bench Metalwork," filmstrip
b. Prentice-Hall, "Machine Shop: Engine Lathe," filmstrip

Student Manuals:

a. Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #21
b. Machine Shop Training Course, Vol. I

Tools and Equipment:

a. Lathe
b. Drilled workpiece
c. Measuring tools
d. Boring tools
e. Safety goggles

LAB HOURS	5
CLASS HOURS	2

EVALUATION (MS-60)

a. Given appropriate tools, supplies and equipment, the student will bore a drilled hole to specified dimensions.

b. V'TECS, Machine Shop, Task No. 87.

TASK

MS-61 Identifying and using mandrels

PERFORMANCE OBJECTIVE

Identify and use mandrels.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Mandrels (or lathe arbors)
b. Purpose of mandrels
c. Tapered mandrels
d. Lathe dog and set screw
e. Lubrication
f. Expanding mandrels
g. Gang mandrels
h. Stub mandrels
    1. Expanding stub mandrels
    2. Threaded stub mandrels
i. Safety

Provide Demonstration On:

Pressing a mandrel into a workpiece

Provide Practical Application On:

a. Pressing a mandrel into a workpiece
b. Identifying types of mandrels in the lab

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Machine Tool Operation, Part I
b. Kibbe, Machine Tool Practices
c. Porter, Machine Shop Operations and Setups

A/Vs:

a. Bergwall, "Bench Metalwork," filmstrip
b. Prentice-Hall, "Machine Shop: Engine Lathe," filmstrip

Student Manuals:

a. Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #22
b. Machine Shop Training Course, Vol. I

Tools and Equipment:

a. Workpiece
b. Mandrel(s)
c. Tools
d. Safety goggles

LAB HOURS	5
CLASS HOURS	2

EVALUATION (MS-61)

Given appropriate tools, supplies and equipment, the student will select and press a mandrel into a workpiece. The student must follow correct procedures and safety procedures.

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TASK

MS-62 Performing knurling operations on the engine lathe

PERFORMANCE OBJECTIVE

Perform knurling operations on the engine lathe.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Knurling
b. Knurling patterns
   1. Diamond
   2. Straight
c. Knurling tool holders
   1. Knuckle-joint holder
   2. Revolving head holder
   3. Straddle holder
d. Holding the work
e. Lubrication
f. Cleaning knurls
g. Knurl cutting tool
h. Safety

Provide Demonstration On:

Making diamond pattern knurls on a rough piece of work

Provide Practical Application On:

Mounting work on a lathe, mounting on knurling tool, and making a diamond pattern knurl

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Machine Tool Operation, Part I
b. Kibbe, Machine Tool Practices
c. Porter, Machine Shop Operations and Setups

A/Vs:

Prentice-Hall, "Machine Shop: Engine Lathe," filmstrip

Student Manuals:

a. Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #23
b. Machine Shop Training Course, Vol. I

Tools and Equipment:

a. Engine lathe
b. Knurling tool
c. Lubricant
d. Measuring tools
e. Safety goggles

LAB HOURS 5

CLASS HOURS 2

EVALUATION (MS-62)

a. Given all necessary tools, supplies and equipment, the student will accurately make diamond pattern knurls on a round workpiece.

b. V'TECS, Machine Shop, Task No. 107.

TASK

MS-63 Performing cutting off operations on the engine lathe

PERFORMANCE OBJECTIVE

Perform cutting off operations on the engine lathe.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Recessing, grooving and parting
b. Types of tools
c. Squaring cut off tools with the work
d. Housekeeping
e. Lubrication
f. Step-parting
g. Chatter
h. Speeds
i. Safety

Provide Demonstration On:

Cutting a groove on a rough workpiece

Provide Practical Application On:

Cutting a groove on a rough workpiece

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Machine Tool Operation, Part I
b. Kibbe, Machine Tool Practices
c. Porter, Machine Shop Operations and Setups

A/Vs:

Bergwall, "Bench Metalwork," filmstrip

Student Manuals:

a. Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #24
b. Machine Shop Training Course, Vol. I

Tools and Equipment:

a. Engine lathe
b. Cutoff tools
c. Lubricant
d. Safety goggles

LAB HOURS	5
CLASS HOURS	2

EVALUATION (MS-63)

Given all necessary tools, supplies and equipment, the student will accurately cut a groove to specified dimensions.

TASK

MS-64 Identifying thread cutting devices

PERFORMANCE OBJECTIVE

Identify thread cutting devices.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Procedure for threading on a lathe
b. Setting up the lathe for threading
    1. Setting dials on the compound and cross-feed
    2. Setting apron controls
c. Spindle speeds
d. Cutting the thread
e. Left-hand threads
f. Multiple point tool
g. Picking up a thread

Provide Demonstration On:

a. Setting the lathe for cutting threads
b. Cutting threads

Provide Practical Application On:

a. Setting up the lathe for cutting a specified thread
b. Cutting the thread

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Machine Tool Operation, Part I
b. Kibbe, Machine Tool Practices
c. Porter, Machine Shop Operations and Setups

A/Vs:

a. Bergwall, "The Lathe Explained," filmstrip
b. Prentice-Hall, "Machine Shop: Engine Lathe," filmstrip

Student Manuals:

a. Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #25
b. Machine Shop Training Course, Vol. I

Tools and Equipment:

a. Lathe
b. Thread cutting tool
c. Safety goggles

LAB HOURS	2
CLASS HOURS	2

EVALUATION (MS-64)

Given all necessary tools and equipment, the student will setup and operate the lathe to cut a specified thread to correct dimensions.

TASK

MS-65 Identifying the parts of a thread

PERFORMANCE OBJECTIVE

Identify the parts of a thread.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Major diameter of a screw
b. Pitch
c. Root and crest
d. Pitch diameter
e. Thread identification
f. Thread depth
g. Sharp-Vee thread form
h. Unified and American National Forms
i. Metric Threads Forms
j. Tolerance symbols

Provide Demonstration On:

Identifying thread designations

Provide Practical Application On:

a. Showing the pitch diameter of a screw on a drawing
b. Showing the depth of a thread on a drawing

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Machine Tool Operation, Part I
b. Kibbe, Machine Tool Practices

Student Manuals:

a. Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #26
b. Machine Shop Training Course, Vol. I

LAB HOURS	5
CLASS HOURS	2

EVALUATION (MS-65)

Given a drawing of a screw, the student will correctly identify the following dimensions on the screw

1. Major diameter
2. Pitch
3. Root and crest
4. Pitch diameter
5. Helix angle
6. Thread depth

TASK

MS-66 Identifying American National thread standards

PERFORMANCE OBJECTIVE

Identify American National thread standards.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Brief history of National Screw Thread Commission
b. Advantages of American National thread form
c. Included angle
d. National form thread series
e. Symbols used in specifying American threads standards
f. Coarse and fine threads

Provide Demonstration On:

Designating American National threads

Provide Practical Application On:

Designating American National threads

INSTRUCTIONAL MATERIALS

Textbooks:

Kibbe, Machine Tool Practices

Student Manuals:

a. Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #27
b. Machine Shop Training Course, Vol. I

LAB HOURS 5

CLASS HOURS 2

EVALUATION (MS-66)

Given basic dimensions, the student will correctly specify American National Thread form designation for the thread.

TASK

MS-67 Computing American National thread form

PERFORMANCE OBJECTIVE

Compute American National thread forms.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. American National thread forms
b. Formulas for
    1. Pitch
    2. Diameter
    3. Major diameter
    4. Minor or root diameter
    5. Root and crest
    6. Single depth
    7. Double depth

Provide Demonstration On:

Computing formulas for
a. Pitch
b. Diameter
c. Major diameter
d. Minor or root diameter
e. Root and crest flats
f. Single depth
g. Double depth

Provide Practical Application On:

Computing formulas for
a. Pitch
b. Diameter
c. Major diameter
d. Minor or root diameter

(Continued on back)

INSTRUCTIONAL MATERIALS

Textbooks:

Burghardt, Machine Tool Operation, Part I

Student Manuals:

a. Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #28
b. Machine Shop Training Course, Vol. I

LAB HOURS	5
CLASS HOURS	2

EVALUATION (MS-67)

Given basic dimensions for American National Form threads, the student will correctly compute the following

a. Pitch
b. Pitch diameter
c. Major diameter
d. Minor or root diameter
e. Root and crest flats
f. Single depth
g. Double depth

TASK

MS-68 Computing sharp V-thread formulas

PERFORMANCE OBJECTIVE

Compute sharp V-thread formuals.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Sharp V-thread
b. Dimensions
    1. Thread angle
    2. Pitch
    3. Depth
    4. Major diameter
    5. Pitch diameter
    6. Minor diameter
    7. Crest
    8. Side
    9. Root
c. Formulas
    1. Thread angle
    2. Pitch
    3. Depth
    4. Minor diameter
    5. Pitch diameter
    6. Major diameter

Provide Demonstration On:

Measuring and computing
a. Thread angle
b. Pitch
c. Depth
d. Minor diameter
e. Pitch diameter
f. Major diameter

Provide Practical Application On:

Measuring and computing
a. Thread angle
b. Pitch
c. Depth
d. Minor diameter
e. Pitch diameter
f. Major diameter

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Machine Tool Operation, Part I
b. Kibbe, Machine Tool Practices

Student Manuals:

a. Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #29
b. Machine Shop Training Course, Vol. I

Tools and Equipment:

a. Sharp V-thread screws
b. Measuring tools

LAB HOURS 5
CLASS HOURS 2

EVALUATION (MS-68)

Given a screw which has sharp V-thread dimensions and appropriate measuring tools, the student will compute the following dimensions accurately.

a. Thread angle
b. Pitch
c. Depth
d. Minor diameter
e. Pitch diameter
f. Major diameter

TASK

MS-69 Identifying acme threads

PERFORMANCE OBJECTIVE

Identify acme threads.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Acme thread
b. Advantages of acme thread form
c. Applications of acme thread
d. Depth vs. pitch
e. Classes
    1. 2G
    2. 3G
    3. 4G
f. Included angle
g. Formulas for pitch, depth and width

Provide Demonstration On:

a. Measuring an acme threaded screw with a wire gage
b. Figuring pitch, depth and width of an acme thread

Provide Practical Application On:

a. Measuring an acme thread with a wire thread gage
b. Figuring pitch, depth and width of an acme thread

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Machine Tool Operation, Part I
b. Kibbe, Machine Tool Practices
c. Porter, Machine Shop Operations and Setups

Student Manuals:

a. Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #30
b. Machine Shop Training Course, Vol. I

Tools and Equipment:

Wire thread gage

LAB HOURS	2
CLASS HOURS	2

EVALUATION (MS-69)

Given a screw or bolt with an acme thread form and appropriate gages, the student will accurately measure the screw or bolt and identify the pitch, depth and width of the threads.

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TASK

MS-70 Using the acme tap

PERFORMANCE OBJECTIVE

Use the acme tap.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Figuring the outside diameter of an acme internal
b. Setting the compound
c. Using an acme screw plug gage
d. Purpose of an acme tap
e. Tap sets
f. Tapping steel (an oil)
g. Tapping bronze (no lubricant)

Provide Demonstration On:

Using the acme tap to cut
a. Steel
b. Bronze

Provide Practical Application On:

Using the acme tap to cut an internal thread to specifications in
a. Steel
b. Bronze

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Machine Tool Operation, Part I
b. Kibbe, Machine Tool Practices
c. Porter, Machine Shop Operations and Setups

A/Vs:

Bergwall, "Bench Metalwork," filmstrip

Student Manuals:

Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #31

Tools and Equipment:

a. Acme tap set
b. Lubricating oil

LAB HOURS	5
CLASS HOURS	2

EVALUATION (MS-70)

Given an acme tap set, bronze and steel work stock, lubricating oil, necessary tools and specifications, the student will tap acme internal threads as specified in steel and bronze material.

TASK

MS-71 Identifying square threads

PERFORMANCE OBJECTIVE

Identify square threads.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Square threads
    1. Purpose
    2. Applications
b. Depth vs. pitch
c. Flank clearance
d. Clearance on major diameter
e. Figuring thickness
f. Figuring pitch, width and depth

Provide Demonstration On:

Figuring the following dimensions on square thread
a. Pitch
b. Width
c. Depth

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Machine Tool Operation, Part I
b. Kibbe, Machine Tool Practices
c. Porter, Machine Shop Operations and Setups

Student Manuals:

a. Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #32
b. Machine Shop Training Course, Vol. I

Tools and Equipment:

a. Bolt with square thread
b. Measuring tools

LAB HOURS	2
CLASS HOURS	2

EVALUATION (MS-71)

Given a square threaded bolt and appropriate measuring tools, the student will correctly figure the pitch, width and depth of the square thread.

TASK

MS-72 Identifying classes of fits of screw threads

PERFORMANCE OBJECTIVE

Identify the classes of fits of screw threads.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. General thread fitting requirements
b. Unified National Course (UNC)
c. Unified National Fine (UNF)
d. Unified National Special (UNS)
e. Classes
   1. 1A, 2A, 3A
   2. 1B, 2B, 3B
f. Identifying screw thread designations

Provide Demonstration On:

Identifying screw thread designations

Provide Practical Application On:

a. Selecting a specified screw thread bolt
b. Identifying classifications and applications of screw thread bolts

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Machine Tool Operation, Part I
b. Kibbe, Machine Tool Practices
c. Porter, Machine Shop Operations and Setups

Student Manuals:

Ohio, Machine Trades I, Engine Lathe Assignment Sheet #33

Tools and Equipment:

Selection of various sizes of threaded bolts

LAB HOURS	2
CLASS HOURS	2

EVALUATION (MS-72)

Given specifications and a selection of threaded bolts, the student will correctly identify the screw thread classification and identify general applications of the type of screw thread.

TASK

MS-73 Using thread gages

PERFORMANCE OBJECTIVE

Use thread gages.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Thread pitch gage
   1. Applications
   2. Reading
b. Center gages
   1. Procedures for use
   2. Applications
c. Plug and ring thread gages
   1. Applications
   2. Procedures for use

Provide Demonstration On:

Using the following gages to gage threads
a. Thread pitch gages
b. Center gages
c. Plug and ring gages

Provide Practical Application On:

Using the following gages to gage assigned threaded bolts
a. Thread pitch gages
b. Center gages
c. Plug and ringe gages

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Machine Tool Operation, Part I
b. Kibbe, Machine Tool Practices
c. Porter, Machine Shop Operations and Setups

A/Vs:

a. Bergwall, "The Lathe Explained," filmstrip
b. Prentice-Hall, "Machine Shop: Engine Lathe," filmstrip

Student Manuals:

Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #34

Tools and Equipment:

a. Thread pitch gage
b. Center gages
c. Plug and ring thread gage
d. Threaded bolts

LAB HOURS	2
CLASS HOURS	2

EVALUATION (MS-73)

Given a series of assigned threaded bolts, the student will use the following gages to accurately measure screw threads.

1. Pitch
2. Center gage
3. Plug and ring thread gage

TASK

MS-74 Using a thread micrometer

PERFORMANCE OBJECTIVE

Use a thread micrometer.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Thread micrometer
   1. Purpose
   2. Parts
   3. Accuracy
b. Thread comparator
   1. Description
   2. Purpose
c. Using the thread micrometer
   1. Points of measurement
   2. Reading the scales

Provide Demonstration On:

Using a thread micrometer

Provide Practical Application On:

Using a thread micrometer to measure assigned threads

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, *Machine Tool Operation*, Part I
b. Kibbe, *Machine Tool Practices*
c. Porter, *Machine Shop Operations and Setups*

A/Vs:

a. Bergwall, "The Lathe Explained," filmstrip
b. Prentice-Hall, "Machine Shop: Engine Lathe," filmstrip

Student Manuals:

a. Ohio, *Machine Trades I*, Engine Lathe Work Assignment Sheet #35
b. *Machine Shop Training Course*, Vol. I

LAB HOURS	5
CLASS HOURS	2

EVALUATION (MS-74)

Given a thread micrometer, the student will accurately measure assigned sizes of threads.

TASK

MS-75 Measuring threads using the three-wire method

PERFORMANCE OBJECTIVE

Measure threads using the three-wire method.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. The three-wire method
b. "Best wire size"
c. Formula for pitch diameter
d. Three-wire gauging sets
e. Formula for best wire size

Provide Demonstration On:

a. Figuring best wire size
b. Figuring pitch diameter with the three wire method

Provide Practical Application On:

Using the three-wire method to figure pitch diameter of threads

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Machine Tool Operation, Part I
b. Kibbe, Machine Tool Practices
c. Porter, Machine Shop Operations and Setups

A/Vs:

a. Bergwall, "The Lathe Explained," filmstrip
b. Prentice-Hall, "Machine Shop: Engine Lathe," filmstrip

Student Manuals:

a. Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #36
b. Machine Shop Training Course, Vol. I

Tools and Equipment:

a. Three-wire gage set
b. Threaded bolts

LAB HOURS 2

CLASS HOURS 2

EVALUATION (MS-75)

Given a three-wire gage set and an assigned set of bolts or other threaded items, the student will use the three-wire method to accurately gage the threads.

TASK

MS-76 Cutting threads with an even geared lathe

PERFORMANCE OBJECTIVE

Cut threads with an even geared lathe.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Even geared lathes (change gear type)
b. Calculating change gears on an even geared lathe
c. Determining number of threads on lead screws
d. Cutting thread on the even geared lathe
e. Changing gears

Provide Demonstration On:

a. Calculating change gears on an even geared lathe
b. Changing gears
c. Cutting threads

Provide Practical Application On:

Making all necessary calculations and settings for cutting threads on an even geared lathe

INSTRUCTIONAL MATERIALS

Textbooks:

Kibbe, Machine Tool Practices

A/Vs:

a. Bergwall, "The Lathe Explained," filmstrip
b. Prentice-Hall, "Machine Shop: Engine Lathe," filmstrip

Student Manuals:

a. Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #37
b. Machine Shop Training Course, Vol. I
c. Georgia, Metals Fabrication Mathematics

Tools and Equipment:

a. Lathe
b. Round stock to be threaded

LAB HOURS 10

CLASS HOURS 5

EVALUATION (MS-76)

Given all necessary tools, supplies and equipment, the student will make all necessary calculations and settings to cut threads on an even geared lathe.

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TASK

MS-77 Cutting threads on a lathe which is not even geared

PERFORMANCE OBJECTIVE

Cut threads on a lathe which is not even geared.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Formula for figuring change gears on lathe which is not even geared
b. Even-geared lathes
c. Lead number
d. Change gears
e. Idle gears
f. Tumbler gears
g. Compound gears

Provide Demonstration On:

a. Figuring gears required to cut a thread
b. Changing out gears
c. Cutting threads

Provide Practical Application On:

Computing formulas for and setting up an uneven geared lathe to cut threads

INSTRUCTIONAL MATERIALS

Textbooks:

Kibbe, Machine Tool Practices

A/Vs:

a. Bergwall, "The Lathe Explained," filmstrip
b. Prentice-Hall, "Machine Shop: Engine Lathe," filmstrip

Student Manuals:

a. Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #38
b. Georgia, Metals Fabrication Mathematics

Tools and Equipment:

a. Uneven geared lathe
b. Gears
c. Wrenches
d. Threading tool
e. Workstock
f. Safety goggles

LAB HOURS 10

CLASS HOURS 5

EVALUATION (MS-77)

Given all necessary tools, supplies and equipment, the student will accurately compute all formuals and setup an uneven geared lathe to cut threads.

TASK

MS-78 Cutting threads on a quick-change gear lathe

PERFORMANCE OBJECTIVE

Cut threads on a quick-change gear lathe.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Thread and feed plate
   1. Description and purpose
   2. Location
b. Quick-change gear
   1. Purpose
   2. Advantage
c. Procedure for setting up quick-change gear lathe
d. Formulas for thread cutting with quick-change gear lathe
e. Double lead screw

Provide Demonstration On:

Setting up the quick-change gear lathe to cut threads

Provide Practical Application On:

Setting up and cutting threads on a quick-change gear lathe

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, *Machine Tool Operation*, Part I
b. Kibbe, *Machine Tool Practices*

A/Vs:

a. Bergwall, "The Lathe Explained," filmstrip
b. Prentice-Hall, "Machine Shop: Engine Lathe," filmstrip

Student Manuals:

a. Ohio, *Machine Trades I*, Engine Lathe Work Assignment Sheet #40
b. *Machine Shop Training Course*, Vol. I

Tools and Equipment:

Quick change gear lathe

LAB HOURS	10
CLASS HOURS	5

EVALUATION (MS-78)

Given a quick-change gear lathe and necessary tools, supplies and equipment, the student will correctly setup the lathe and cut threads on an assigned workpiece.

TASK

MS-79 Identifying multiple lead screw threads

PERFORMANCE OBJECTIVE

Identify multiple lead screw threads.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Multiple lead screw threads
    1. Description
    2. Purpose
    3. Lead
    4. Pitch
b. Applications of
    1. Single lead screws
    2. Double lead screws
    3. Triple lead screws
    4. Multiple lead screws

Provide Practical Application On:

Identifying parts and dimensions of multiple lead screws

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Machine Tool Operation, Part I
b. Kibbe, Machine Tool Practices
c. Porter, Machine Shop Operations and Setups

A/Vs:

a. Bergwall, "The Lathe Explained," filmstrip
b. Prentice-Hall, "Machine Shop: Engine Lathe," filmstrip

Student Manuals:

Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #41

Tools and Equipment:

a. Examples of multiple lead screws
b. Measuring tools

LAB HOURS 2

CLASS HOURS 2

EVALUATION (MS-79)

Given several multiple lead screws, the student will identify the parts of the screw and accurately measure the dimensions.

TASK

MS-80 Cutting left hand threads

PERFORMANCE OBJECTIVE

Cut left hand threads.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Lathe setup for left hand threads
b. Symbols used for left hand threads
c. Necking a shaft
d. Left hand dies and taps

Provide Demonstration On:

Cutting left hand threads using
a. Threading tool
b. Dies
c. Taps

Provide Practical Application On:

Cutting left hand threads on the lathe using
a. Threading tool
b. Dies
c. Taps

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Machine Tool Operation, Part I
b. Kibbe, Machine Tool Practices
c. Porter, Machine Shop Operations and Setups

A/Vs:

a. Bergwall, "The Lathe Explained," filmstrip
b. Prentice-Hall, "Machine Shop: Engine Lathe," filmstrip

Student Manuals:

Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #42

Tools and Equipment:

a. Lathe and tools to cut left hand threads
b. Left hand dies and taps

LAB HOURS 5

CLASS HOURS 2

EVALUATION (MS-80)

Given an engine lathe and appropriate tools, supplies and materials, the student will accurately cut left hand threads to specified dimensions.

TASK

MS-81 Determining a tap drill size

PERFORMANCE OBJECTIVE

Determine a tap drill size.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Tap drills
   1. Description
   2. Use
b. Formula for tap drill size of American Standard Screw Thread
c. 75% rule
d. Problems of tapping
e. Using a tap drill when exact size is not available
f. Safety

Provide Demonstration On:

Computing tap drill size for a specified job

Provide Practical Application On:

Computing tap drill size for a specified job

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Machine Tool Operation, Part I
b. Kibbe, Machine Tool Practices
c. Porter, Machine Shop Operations and Setups

A/Vs:

a. Bergwall, "The Lathe Explained," filmstrip
b. Prentice-Hall, "Machine Shop: Engine Lathe," filmstrip

Student Manuals:

a. Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #43
b. Machine Shop Training Course, Vol. II

LAB HOURS	2
CLASS HOURS	2

EVALUATION (MS-81)

Given specifications for a tapping operation, the student will accurately select the appropriate size tap drill for the job.

TASK

MS-82 Cutting internal threads and performing tapping operation

PERFORMANCE OBJECTIVE

Cut internal threads and perform tapping operation.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Types of steel used to make taps
b. Cutting internal threads on a lathe
    1. Setting the compound
    2. Lubricants used
c. Using the center gage
d. Blind holes (gaging)
e. Truing up the work
f. Chatter
g. Using the graduated collar for internal threading
h. Safety

Provide Demonstration On:

a. Cutting internal threads on an engine lathe
b. Tapping on an engine lathe

Provide Practical Application On:

Performing internal thread cutting and tapping operations on the engine lathe

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Machine Tool Operation, Part I
b. Kibbe, Machine Tool Practices
c. Porter, Machine Shop Operations and Setups

A/Vs:

a. Bergwall, "The Lathe Explained," filmstrip
b. Prentice-Hall, "Machine Shop: Engine Lathe," filmstrip

Student Manuals:

Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #44

Tools and Equipment:

a. Engine lathe
b. Bored workpiece
c. Depth gage
d. Center gage
e. Thread cutting tools
f. Tapping set
g. Safety goggles

LAB HOURS 5

CLASS HOURS 2

EVALUATION (MS-82)

a. Given necessary tools, supplies and equipment, the student will cut internal threads to specified dimensions and correctly perform tapping of the internal threads.

b. V'TECS, Machine Shop, Task No. 92.

TASK

MS-83 Identifying principles of taper turning

PERFORMANCE OBJECTIVE

Identify basic principles of taper turning.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Uses of tapers
b. Taper series
    1. Brown
    2. Sharpe
    3. Morse
c. Taper sizes
d. Tapering methods
    1. Compound slide method
    2. Offset tailstock method
    3. Taper attachment method
e. Procedure for setting up the taper attachment
f. Measurement tapers

Provide Demonstration On:

a. Figuring amount of taper in taper per foot (TPF)
b. Setting up the taper attachment
c. Measuring tapers

Provide Practical Application On:

a. Figuring the amount of taper for a specified job (in TPF)
b. Setting up the taper attachment
c. Measuring tapers

INSTRUCTIONAL MATERIALS

Textbooks:

Kibbe, Machine Tool Practices

A/Vs:

a. Bergwall, "The Lathe Explained," filmstrip
b. Prentice-Hall, "Machine Shop: Engine Lathe," filmstrip

Student Manuals:

a. Ohio, Machine Trades I, Engine Lathe Assignment Sheet #45
b. Machine Shop Training Course, Vol. I

Tools and Equipment:

a. Engine lathe
b. Taper attachment
c. Inside and outside taper micrometers
d. Sine bar and gage blocks
e. Ring gage

LAB HOURS	2
CLASS HOURS	2

EVALUATION (MS-83)

a. Given appropriate tools, supplies and equipment, the student will calculate a specified taper in (TPF), correctly setup the taper attachment on the engine lathe for a specified taper and use assigned measuring instruments to accurately measure given tapers.

b. V'TECS, Machine Shop, Task No. 90.

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TASK

MS-84 Computing tapers

PERFORMANCE OBJECTIVE

Compute tapers.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Formula for finding taper per foot (TPF)
b. Taper length formula
c. Finding taper per inch (TPI)

Provide Demonstration On:

a. Computing TPF
b. Converting to TPI
c. Computing taper length

Provide Practical Application On:

Computing a taper in terms of taper per foot (TPF), taper per inch (TPI) and taper length

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Machine Tool Operation, Part I
b. Kibbe, Machine Tool Practices
c. Porter, Machine Shop Operations and Setups

A/Vs:

a. Bergwall, "The Lathe Explained," filmstrip
b. Prentice-Hall, "Machine Shop: Engine Lathe," filmstrip

Student Manuals:

a. Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #46
b. Machine Shop Training Course, Vol. I

LAB HOURS 2

CLASS HOURS 2

EVALUATION (MS-84)

Given basic dimensions for a tapering operation, the student will make correct computations for taper in terms of taper per foot, taper per inch and taper length.

TASK

MS-85 Measuring short tapers

PERFORMANCE OBJECTIVE

Measure short tapers.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Angles
    1. Right angle
    2. Acute angle
    3. Obtuse angle
b. Dimensioning of abrupt tapers on mechanical drawings
c. Vernier bevel protractor
d. Sine bar
e. Formula for taper angle for sharp pointed taper
f. Formula for taper angle when TPF is known
g. Subdivisions of a degree
h. Vertex of an angle

Provide Demonstration On:

a. Measuring a sharp pointed taper
b. Computing taper from TPF

Provide Practical Application On:

a. Measuring a sharp pointed taper
b. Computing taper given TPF

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Machine Tool Operation, Part I
b. Kibbe, Machine Tool Practices
c. Porter, Machine Shop Operations and Setups

A/Vs:

a. Bergwall, "The Lathe Explained," filmstrip
b. Prentice-Hall, "Machine Shop: Engine Lathe," filmstrip

Student Manuals:

a. Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #47
b. Machine Shop Training Course, Vol. I

Tools and Equipment:

a. Vernier bevel protractor
b. Sine bar and blocks

LAB HOURS	2
CLASS HOURS	2

EVALUATION (MS-85)

a. Given a sharp pointed taper and necessary measuring tools, the student will correctly measure and compute the taper.

b. Given the taper per foot of a taper, the student will correctly compute the taper angle.

TASK

MS-86 Gaging inside and ouside tapers

PERFORMANCE OBJECTIVE

Gage inside and outside tapers.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Gaging tapers
b. Gaging tapered bores
c. Taper plug gage
d. Taper ring gage
e. Using chalk or prussian blue
f. Taper micrometers
    1. Inside
    2. Outside

Provide Demonstration On:

a. Using the plug gage
b. Using the ring gage
c. Using taper micrometers

Provide Practical Application On:

Measuring tapers using
a. Plug gage
b. Ring gage
c. Taper micrometers (inside and outside)

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Machine Tool Operation, Part I
b. Kibbe, Machine Tool Practices
c. Porter, Machine Shop Operations and Setups

A/Vs:

a. Bergwall, "The Lathe Explained," filmstrip
b. Prentice-Hall, "Machine Shop: Engine Lathe," filmstrip

Student Manuals:

Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #48

Tools and Equipment:

a. Taper ring and plug gages
b. Taper micrometers

LAB HOURS	2
CLASS HOURS	2

EVALUATION (MS-86)

Given an assigned set of inside and outside tapers, the student will accurately measure inside and outside tapers using plug gages, ring gages and inside and outside taper micrometers.

TASK

MS-87 Tapering using the offset tailstock method

PERFORMANCE OBJECTIVE

Taper using the offset tailstock method.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Types of tapers which are turned using offset tailstock method
b. Formulas for offset
  1. Given TPI
  2. Given TPF
  3. General formula
c. Turning a taper between centers
d. Measuring the offset
e. Using the cross slide

Provide Demonstration On:

Turning a taper using the offset tailstock method

Provide Practical Application On:

Turning a taper using the offset tailstock method

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Machine Tool Operation, Part I
b. Kibbe, Machine Tool Practices
c. Porter, Machine Shop Operations and Setups

A/Vs:

a. Bergwall, "The Lathe Explained," filmstrip
b. Prentice-Hall, "Machine Shop: Engine Lathe," filmstrip

Student Manuals:

a. Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #49
b. Machine Shop Training Course, Vol. I

Tools and Equipment:

a. Lathe
b. Rules
c. Dial indicator
d. Safety goggles

LAB HOURS	5
CLASS HOURS	2

EVALUATION (MS-87)

Given necessary tools, equipment and supplies, the student will turn a taper on the engine lathe using the offset tailstock method.

TASK

MS-88 Cutting a taper using the compound rest

PERFORMANCE OBJECTIVE

Cut a taper using the compound rest.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Setting the cutting tool on center
b. Compound rest method of cutting a taper
    1. Procedure
    2. Applications
c. Procedures for feeding the tool
d. Positions of zero on compound rest
e. Safety

Provide Demonstration On:

Cutting a taper using the compound rest method

Provide Practical Application On:

Cutting a taper on the engine lathe using the compound rest method

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Machine Tool Operation, Part I
b. Kibbe, Machine Tool Practices
c. Porter, Machine Shop Operations and Setups

A/Vs:

a. Bergwall, "The Lathe Explained," filmstrip
b. Prentice-Hall, "Machine Shop: Engine Lathe," filmstrip

Student Manuals:

a. Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #50
b. Machine Shop Training Course, Vol. I

Tools and Equipment:

a. Engine lathe
b. Workstock
c. Cutting tool
d. Safety goggles
e. Measuring instruments

LAB HOURS 5

CLASS HOURS 2

EVALUATION (MS-88)

Given necessary tools, equipment and materials, the student will cut a taper on the engine lathe using the compound rest method.

TASK

MS-89 Cutting a taper using the taper attachment

PERFORMANCE OBJECTIVE

Cut a taper using a taper attachment.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. The taper attachment
b. Advantages of using the taper attachment
c. Reading graduations on the swivel bar
d. Locking the swivel bar
e. "Lost motion"

Provide Demonstration On:

a. Setting the swivel bar correctly
b. Making a trial cut

Provide Practical Application On:

Cutting a taper on the engine lathe using a taper attachment

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Machine Tool Operation, Part I
b. Kibbe, Machine Tool Practices
c. Porter, Machine Shop Operations and Setups

A/Vs:

a. Bergwall, "The Lathe Explained," filmstrip
b. Prentice-Hall, "Machine Shop: Engine Lathe," filmstrip

Student Manuals:

Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #51

Tools and Equipment:

a. Engine lathe
b. Taper attachment
c. Measuring tools

LAB HOURS	5
CLASS HOURS	2

EVALUATION (MS-89)

Given necessary tools, equipment and materials, the student will cut a taper to specified dimensions.

TASK

MS-90 Boring or turning internal tapers

PERFORMANCE OBJECTIVE

Bore or turn internal tapers.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Boring internal tapers
   1. Compound slide method
   2. Taper attachment method
b. "Lost motion"
c. Gaging internal taper
d. Finishing internal tapers

Provide Demonstration On:

Boring an internal taper

Provide Practical Application On:

Boring an internal taper to specified dimensions

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Machine Tool Operation, Part I
b. Kibbe, Machine Tool Practices

A/Vs:

a. Bergwall, "The Lathe Explained," filmstrip
b. Prentice-Hall, "Machine Shop: Engine Lathe," filmstrip

Student Manuals:

Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #52

Tools and Equipment:

a. Engine lathe and cutting tools
b. Workstock
c. Safety goggles
d. Gages

LAB HOURS	5
CLASS HOURS	2

EVALUATION (MS-90)

a. Given necessary tools, equipment and materials, the student will bore and finish an internal taper to specified dimensions.

b. V'TECS, Machine Shop, Task No. 94.

TASK

MS-91 Identifying coolants and cutting compounds

PERFORMANCE OBJECTIVE

Identify coolants and cutting compounds.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Coolants
b. Cutting compounds
c. Functions of a cutting compound
d. Emulsifying or soluble oils
e. Methods of coolant application
f. When to use a coolant or cutting compound

Provide Demonstration On:

a. Choosing a cutting compound
b. Choosing a coolant

Provide Practical Application On:

Choosing a coolant or cutting compound for specified lathe work

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, *Machine Tool Operation*, Part I
b. Kibbe, *Machine Tool Practices*
c. Porter, *Machine Shop Operations and Setups*

A/Vs:

Prentice-Hall, "Machine Shop: Engine Lathe," filmstrip

Student Manuals:

a. Ohio, *Machine Trades I*, Engine Lathe Work Assignment Sheet #53
b. *Machine Shop Training Course*, Vol. I

Tools and Equipment:

a. Coolant catalog
b. Cutting compound catalog

LAB HOURS 2
CLASS HOURS 2

EVALUATION (MS-91)

Given specifications for a specific job to be done on the lathe, the student will accurately identify the appropriate coolant or cutting compound.

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TASK

MS-92 Identifying lubricants

PERFORMANCE OBJECTIVE

Identify lubricants.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. The wear on machine tools
b. Properties of lubricating oils
c. When greases are used
d. Lubricants for ball and roller bearings
e. One-shot lubrication systems
f. Viscosity

Provide Demonstration On:

Choosing a lubricant or grease according to lubrication specifications for an engine lathe

Provide Practical Application On:

Choosing a lubricant or grease for an assigned lathe in the lab according to specifications for the machine

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Machine Tool Operation, Part I
b. Kibbe, Machine Tool Practices

A/Vs:

Bergwall, "Machine Shop: Engine Lathe," filmstrip

Student Manuals:

Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #54

Tools and Equipment:

Manufacturer's lubricant and grease catalog

LAB HOURS	2
CLASS HOURS	2

EVALUATION (MS-92)

Given an assigned lathe and lubrication specifications, the student will correctly choose a lubricator grease for the machine he/she is using.

TASK

WLD-01 Identifying and using welding symbols

PERFORMANCE OBJECTIVE

Identify and use welding symbols.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Uses of welding symbols
b. The basic welding symbol
  1. Reference line
  2. Arrow
  3. Tail
  4. Arrow side
  5. Other side
c. Weld symbols for type of joint or weld
  1. Groove (Square, V, Bevel, U, J, Flare-V and Flare-Bevel)
  2. Fillet
  3. Plug or slot
  4. Seam
  5. Back or backing
  6. Surfacing
  7. Flange

(Continued on back)

Provide Demonstration On:

Standard and supplementary symbols and their meanings

Provide Practical Application On:

a. Interpreting symbols from shop sketches and drawings
b. Drawing symbols for various types of welds

INSTRUCTIONAL MATERIALS

Textbooks:

a. Griffin, Welding Processes
b. Schell and Matlock, Industrial Welding Procedures

Tools and Equipment:

a. American Welding Society Chart of Standard Welding Symbols
b. Samples of various types of welded joints
c. Shop sketches

LAB HOURS	4
CLASS HOURS	10

EVALUATION (WLD-01)

Given an American Welding Society Chart of Welding Symbols, the student will correctly identify symbols that appear on the chart and draw symbols to represent sample welds presented by the instructor.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

d. Dimensions
e. Supplementary symbols
    1. Weld-all-around
    2. Field weld
    3. Melt-thru
    4. Contour
    5. Finish
    6. Groove, angle
    7. Abbreviations
    8. Size: size or strength
    9. Effective throat
    10. Root opening
    11. Length of weld
    12. Pitch
    13. Number of spot or projection welds

TASK

WLD-02 Using welding related shop tools

PERFORMANCE OBJECTIVE

Demonstrate the proper and safe use and care of welding related hand and powered tools and equipment.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Proper care and use of common hand tools
   1. Hammers
   2. Hand saws
   3. Chisels and punches
   4. Brushes
   5. Files
   6. Marking tools
   7. Rules, straight edges, squares, dividers, etc.

b. Proper care and use of common powered tools and equipment
   1. Chipping hammer
   2. Drills
   3. Grinders
   4. Power saws

(Continued on back)

Provide Demonstration On:

The use and care of common shop tools and equipment

Provide Practical Application On:

Using and caring for shop tools and equipment

INSTRUCTIONAL MATERIALS

Textbooks:

a. Griffin, Welding Processes
b. Schell and Matlock, Industrial Welding Procedures

Tools and Equipment:

Common shop tools and equipment used in welding

LAB HOURS 25

CLASS HOURS 10

EVALUATION (WLD-02)

Provided with necessary materials, the student will correctly identify and demonstrate the proper use and care of common tools and equipment used in welding.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

5. Power brushes
6. Shears
7. Punches

TASK

WLD-03 Identifying and preparing metals for welding

PERFORMANCE OBJECTIVE

Identify and prepare metals for welding.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Metals important to welders
    1. Low carbon steel
    2. Medium carbon steel
    3. High carbon steel
    4. Stainless steel
    5. Manganese
    6. Grey cast iron
    7. Malleable cast iron
    8. Copper
    9. Brass
    10. Bronze
    11. Lead
    12. Aluminum
    13. Magnesium
    14. White metals
    15. White cast iron

(Continued on back)

Provide Demonstration On:

a. Samples of different types of metals
b. Identifying metals by testing

Provide Practical Application On:

Spark testing
1. Brass
2. Steel
3. Cast iron

INSTRUCTIONAL MATERIALS

Textbooks:

a. Georgia, *Welding, Instructor Guide*
b. Giachino and Weeks, *Welding Skills and Practices*
c. Griffin, *Welding Processes*
d. Oregon, *Welding*

A/Vs:

Georgia, "Metallurgy," slide/tape

Student Manuals:

Georgia, *Welding, Phase A, Unit 7*

Tools and Equipment:

a. One brass welding rod
b. One steel welding rod
c. One cast iron welding rod
d. Safety shield
e. Gloves
f. Metal plates

LAB HOURS 25

CLASS HOURS 10

EVALUATION (WLD-03)

a. Given samples of the fifteen types of metals listed in this unit, the student will correctly identify each sample by name and by its physical, mechanical and chemical properties.

b. Test items are available in Welding, Instructor Guide, Vol. III, Test A-7.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

b. Physical properties of
    1. Tensile strength
    2. Ductility
    3. Brittleness
    4. Stress and strain
    5. Elasticity
    6. Compression strength
    7. Fatigue strength
    8. Toughness
    9. Hardness
    10. Corrosion resistance
    11. Weldability
    12. Elongation
    13. Malleability

c. Chemical Properties
    1. Composition
    2. Melting point

d. Mechanical properties
    1. Effect of heat on metals
    2. Effect of cold on metals
    3. Relationship to physical properties

e. Spark testing
    1. Method
    2. Meaning of
        - Color of spark stream
        - Length of spark stream
        - Number of explosions (spurts or sprigs)
        - Shape of explosions (forked or repeating)
    3. Spark testing chart

f. Other tests
    1. Ocyacetylene cutting torch test
    2. Magnetic test
    3. Ring test
    4. Chipping test
    5. Filing test
    6. Fracture test
    7. Functional test
    8. Chemical tests

g. Identification of structural shapes
    1. Sheet and plate - hot and cold rolled
    2. Bars
        - Hot and cold rolled
        - Square - hot and cold rolled
        - Round
        - Hexagon or octagon
        - Half round or oval
        - Angle bars
        - Zee bars
    3. Standard I-beam
    4. H-beam
    5. Wide flange beam
    6. Channel
    7. Ship channel
    8. Standard pipe
    9. Tubing
    10. Square tubing
    11. Rectangular tubing
    12. Functions and characteristics and specifications of structural shapes

h. Meaning of gage

i. Preparing metals for welding
    1. Cleaning
    2. Preparing edges
        - Chamfer
        - Bevel
        - Root opening
        - Bevel on both sides

EVALUATION (WLD-03)

INSTRUCTIONAL ACTIVITIES

Provide Information On:

- Welding joint on both sides
- When to use edge types
- How to make edge types

j. Heat treating process
    1. Annealing
    2. Hardening
    3. Case hardening

TASK

WLD-04 Measuring welding materials

PERFORMANCE OBJECTIVE

Measure welding materials.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Measurement equipment
   1. Rulers (steel rule)
   2. Straight edges
   3. Squares
   4. Soap stone markers
   5. Micrometers (vernier micrometer)
   6. Vernier calipers
   7. Dial indicators
   8. Telescope and small hole gauges
   9. Use of equipment
   10. Function of equipment
   11. Degree of accuracy
b. Measurement techniques
c. English and metric measuring units

(Continued on back)

Provide Demonstration On:

Types of measurement instruments, their operations and their uses

Provide Practical Application On:

Marking a metal for cutting and welding

INSTRUCTIONAL MATERIALS

Textbooks:

a. Georgia, Welding, Instructor Guide
b. Oregon, Welding

Student Manuals:

Georgia, Welding, Phase A, Unit A-7A

Tools and Equipment:

a. One piece of light gage sheet metal at least 5" x 7"
b. One square
c. One piece of soap stone
d. Ruler
e. Straight edges
f. Micrometer
g. Calipers
h. Telescope and small hole gauges

LAB HOURS	3
CLASS HOURS	4

EVALUATION (WLD-04)

Given proper equipment, the student will measure a length of metal to the nearest 1/16 inch and mark off six parallel lines spaced within 1/16 inch of given dimensions.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

1. Decimals
2. Fractions
3. Conversions

TASK

WLD-05 Using clamps and jigs

PERFORMANCE OBJECTIVE

Use clamps and jigs.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. The importance of clamps and jigs
b. Using C-clamps
c. Jigs for butt joints
d. Jigs for corner joints
e. Jigs for T-joints
f. Using copper inserts
g. Backing bars
h. Heat sinks
i. Positioning pipe

Provide Demonstration On:

Different types of jigs and their uses

Provide Practical Application On:

Properly setting up joints for welding using appropriate clamping and jigs

INSTRUCTIONAL MATERIALS

Textbooks:

Griffin, Basic TIG & MIG

Tools and Equipment:

a. C-clamps
b. Butt joint jig
c. Corner joint jig
d. T-joint jig
e. Pipe joint jig
f. Heat sinks
g. Backing bars
h. Copper inserts
i. Various metals to be clamped

LAB HOURS	3
CLASS HOURS	4

EVALUATION (WLD-05)

Given one or more of each of the types of clamps and jigs covered in this unit, the student will demonstrate the correct use of clamps and jigs in setting up metals for standard joint welds.

TASK

WLD-06 Reading blueprints

PERFORMANCE OBJECTIVE

Read blueprints.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Uses of blueprints
b. Basic lines
c. Basic views
d. Notes and specifications
e. Dimensions
f. Structural shapes
g. Auxiliary views
h. Sections
i. Detail and assembly prints
j. Welding abbreviations and symbols
k. Fabrication

Provide Demonstration On:

Completed projects and their corresponding blueprints

Provide Practical Application On:

a. Reading and interpreting blueprints
b. Matching blueprints with finished products

INSTRUCTIONAL MATERIALS

Tools and Equipment:

a. Assorted blueprints
b. Completed welding projects and their corresponding blueprints

LAB HOURS	25
CLASS HOURS	15

EVALUATION (WLD-06)

Given a set of blueprints and their corresponding finished products, the student will accurately interpret blueprints and match blueprint requirements with finished products.

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TASK

OXA-01 Following safety procedures and regulations for oxyacetylene welding

PERFORMANCE OBJECTIVE

Follow safety procedures and regulations for oxyacetylene welding.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. General safety precautions for welding
b. Safety hazards
    1. Causes for explosions
    2. Fire hazards
    3. Handling hot metals
    4. Toxic fumes
c. Safety equipment
    1. Protective clothing
    2. Fire extinguishers
    3. Safety devices on equipment
d. Shop safety rules
    1. Safety habits and regulations
    2. Cleanliness
    3. Fire prevention

(Continued on back)

Provide Demonstration On:

Types and uses of safety equipment

Provide Practical Application On:

Using fire extinguishers

INSTRUCTIONAL MATERIALS

Textbooks:

a. Georgia, Welding, Instructor Guide
b. Giachino and Weeks, Welding Skills and Practices
c. Griffin, Basic Oxyacetylene
d. Althouse, Modern Welding

A/Vs:

Georgia, Welding, "Safety," slide/tapes A-5A and A-5B

Student Manuals:

Georgia, Welding, Phase A, Unit 5

Tools and Equipment:

a. Fire extinguishers
b. Protective clothing
c. Oxyacetylene equipment

LAB HOURS	1
CLASS HOURS	3

EVALUATION (OXA-01)

a. Given the types of equipment used in oxyacetylene welding, the student will demonstrate safe practices in handling and using the equipment.

b. Test items are available in Welding, Instructor Guide, Vol. II, Test A-5.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

4. Safe placement and handling of equipment

e. What to do in case of an accident

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TASK

OXA-02 Using oxyacetylene cylinders and gases

PERFORMANCE OBJECTIVE

Use oxyacetylene cylinders and gases.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Gases and their properties
   1. Oxygen
   2. Acetylene
   3. Other gases

b. Gas cylinders
   1. Operating instructions
   2. Safety precautions
   3. Care and maintenance
      - Cleaning
      - Testing for leaks
      - What to do if equipment needs repair
      - Transporting and handling

c. Safety rules in using gases

Provide Demonstration On:

Correct handling of cylinders and the use of safety chains

Provide Practical Application On:

Testing for leaks

INSTRUCTIONAL MATERIALS

Textbooks:

a. Georgia, Welding, Instructor Guide
b. Giachino and Weeks, Welding Skills and Practices
c. Griffin, Basic Oxyacetylene
d. Althouse, Modern Welding
e. Oregon, Welding

A/Vs:

Georgia, Welding, "Cylinders and Gases," slide/tape

Student Manuals:

Georgia, Welding, Phase A, Unit 2

LAB HOURS	4
CLASS HOURS	3

EVALUATION (OXA-02)

a. Given a set of oxyacetylene cylinders, hoses, regulators and related apparatus, the student will demonstrate correct procedures for handling, storage and leak testing.

b. Test items are available in Welding, Instructor Guide, Vol. II, Test A-2.

c. V'TECS, Welder, Tasks 39 and 41.

TASK

OXA-03 Inspecting oxygen and acetylene regulators

PERFORMANCE OBJECTIVE

Inspect oxygen and acetylene regulators.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

Oxyacetylene regulators
1. Individual parts
2. How it operates
   - Turning on valves
   - Reading gages
3. Safety precautions and hazards
4. Purpose of regulator
5. Capacity of regulator

Provide Demonstration On:

Disassembly, inspection and reassembly of regulators

Provide Practical Application On:

Disassembly, inspection and reassembly of regulators

INSTRUCTIONAL MATERIALS

Textbooks:

a. Georgia, Welding, Instructor Guide
b. Giachino and Weeks, Welding Skills and Practices
c. Griffin, Basic Oxyacetylene
d. Althouse, Modern Welding
e. Oregon, Welding

A/Vs:

Georgia, Welding, "Regulators," slide/tape

Student Manuals:

Georgia, Welding, Phase A, Unit 3

Tools and Equipment:

a. Vice
b. Screwdrivers
c. Adjustable wrench
d. Box end wrench set
e. Demonstration single stage regulator

LAB HOURS	4
CLASS HOURS	3

EVALUATION (OXA-03)

a. Given the equipment listed for this task, the student will correctly disassemble the regulator, identify the parts and reassemble the regulator according to procedures covered in this unit.

b. Test items are available in Welding, Instructor Guide, Vol. II, Test A-3.

c. V'TECS, Welder, Tasks 39 and 41.

TASK

OXA-04 Selecting and maintaining oxyacetylene torches and tips

PERFORMANCE OBJECTIVE

Select and maintain oxyacetylene torches and tips.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Torch parts
    1. Body or torch handle
    2. Needle valves
    3. Mixer
    4. Tip
b. Function of parts
c. Types of torches
    1. Injector torch
    2. Equal pressure torch
    3. Function of each type
d. Tip
    1. Care
    2. Sizes - chart of tip sizes
    3. Drilling and cutting tips

Provide Practical Application On:

Selecting and cleaning torches and tips

INSTRUCTIONAL MATERIALS

Textbooks:

a. Georgia, Welding, Instructor Guide
b. Giachino and Weeks, Welding Skills and Practices
c. Griffin, Basic Oxyacetylene
d. Althouse, Modern Welding
e. Oregon, Welding

A/Vs:

Georgia, Welding, "Torches and Tips," slide/tape

Student Manuals:

Georgia, Welding, Phase A, Unit 4

Tools and Equipment:

a. Welding tips
b. Tip drills
c. Tip cleaners
d. Injector torch
e. Equal pressure torch

LAB HOURS	2
CLASS HOURS	2

EVALUATION (OXA-04)

a. Given specifications for different types of welding jobs, the student will correctly select the proper size and type tip for each job.

b. The student will demonstrate the proper procedures for maintaining torch tips.

c. Test items are available in Welding, Instructor Guide, Vol. II, Test A-4.

d. V'TECS, Welder, Task 42.

TASK

OXA-05 Setting up and lighting the oxyacetylene torch

PERFORMANCE OBJECTIVE

Set up and light the oxyacetylene torch.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Sequence of the torch lighting process
b. Lighting the torch and adjusting the flame
c. Sequence of the depressurizing process
d. Flame types
    1. Neutral
    2. Carburizing
    3. Oxidizing
    4. Function of each flame type
    5. Flame zones
        - Cone
        - Envelope
        - Feather
e. Care and maintenance of equipment

Provide Demonstration On:

Correct torch lighting and shut-down procedures

Provide Practical Application On:

Setting up and lighting the torch
a. Setting up the apparatus
b. Lighting and adjusting the torch
c. Shutting down the apparatus

INSTRUCTIONAL MATERIALS

Textbooks:

a. Georgia, Welding, Instructor Guide
b. Giachino and Weeks, Welding Skills and Practices
c. Griffin, Basic Oxyacetylene
d. Althouse, Modern Welding
e. Oregon, Welding

A/Vs:

Georgia, Welding, "Setting up and Lighting the Torch," slide/tape

Student Manuals:

Georgia, Welding, Phase A, Unit 6

Tools and Equipment:

Oxyacetylene welding apparatus

LAB HOURS 2

CLASS HOURS 2

EVALUATION (OXA-05)

a. Given proper equipment, the student will set up and light a torch for welding and adjust to a neutral flame, a carburizing flame and an oxidizing flame. The student will then shut down the torch and secure equipment according to approved procedures.

b. Test items are available in Welding, Instructor Guide, Vol. II, Test A-6.

TASK

OXA-06 Carrying a puddle without a filler rod

PERFORMANCE OBJECTIVE

Carry a puddle without a filler rod.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Terminology
    1. Beads
    2. Filler rods
    3. Puddle
    4. Carrying a puddle
    5. Torch motion
        - Circular
        - Zig zag
        - Alternating rod
        - Zipper
        - Oscillating
    6. Forehand welding
    7. Backhand welding

b. Characteristics that guide proper puddling of a metal
    1. Penetration
    2. Torch adjustment

(Continued on back)

Provide Demonstration On:

Method of carrying a puddle without a rod

Provide Practical Application On:

Making a plate with four beads without a filler rod

INSTRUCTIONAL MATERIALS

Textbooks:

a. Georgia, Welding, Instructor Guide
b. Giachino and Weeks, Welding Skills and Practices
c. Griffin, Basic Oxyacetylene
d. Althouse, Modern Welding
e. Oregon, Welding

A/Vs:

Georgia, Welding, "Carrying a Puddle Without a Rod," slide/tape

Student Manuals:

Georgia, Welding, Phase A, Unit 8

Tools and Equipment:

a. Oxyacetylene welding apparatus
b. Light gage mild steel plate

LAB HOURS	8
CLASS HOURS	4

EVALUATION (OXA-06)

Using proper oxyacetylene equipment, the student will produce one 4" x 6" plate with 4 beads 5 inches long without using a filler rod. These beads must be straight, uniform and evenly spaced.

INSTRUCTIONAL ACTIVITIES

Provide Information on:

    3. Torch handling
    4. Torch movement
    5. Torch speed
    g. Angle of torch to metal
c. Appearance of puddle surface

TASK

OXA-07 Welding an outside corner joint without a filler rod

PERFORMANCE OBJECTIVE

Weld an outside corner joint without a filler rod.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Terminology
    1. Corner joint
    2. Base metal
    3. Weld
    4. Groove
    5. Fillet welds
b. Procedure for welding corner joint
    1. Torch angle
    2. Motion of torch
    3. Torch speed
    4. Flame type
c. Positioning of metals to each other
d. Standard for a good joint

Provide Demonstration On:

a. Examples of good corner joint welds
b. Proper welding technique
c. Errors and their causes

Provide Practical Application On:

Welding an outside corner joint in the flat, horizontal, vertical and overhead position without the use of a filler rod

(Continued on back)

INSTRUCTIONAL MATERIALS

Textbooks:

a. Georgia, Welding, Instructor Guide
b. Giachino and Weeks, Welding Skills and Practices
c. Griffin, Basic Oxyacetylene
d. Althouse, Modern Welding
e. Oregon, Welding

A/Vs:

Georgia, Welding, "Welding an Outside Corner Joint," slide/tape

Student Manuals:

Georgia, Welding, Phase A, Unit 9

Tools and Equipment:

a. Oxyacetylene welding apparatus
b. Light gage mild steel plate

LAB HOURS	6
CLASS HOURS	10

EVALUATION (OXA-07)

a. Using proper oxyacetylene equipment, the student will weld an outside corner joint in flat, horizontal, vertical and overhead positions. The joints should be uniform in appearance and have complete penetration and fusion.

b. V'TECS, Welder, Task 19.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

e. Testing joints
f. When to weld joints without a rod (thin gage metals)

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TASK

OXA-08 Making beads with filler rods

PERFORMANCE OBJECTIVE

Make beads with filler rods.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Filler rods
    1. Types and sizes
    2. When to use
    3. Selecting the correct filler rod
b. Using the rod correctly
    1. Angle and motion of rod
    2. Distance from torch and metal
c. Errors and their causes
    1. Burn through
    2. Chilling puddle
    3. Failure to absorb enough heat
d. Correct use of the torch

Provide Demonstration On:

a. Examples of good bead welds
b. Examples of poor welds and their causes

Provide Practical Application On:

Making a plate of beads with a filler rod

INSTRUCTIONAL MATERIALS

Textbooks:

a. Georgia, *Welding, Instructor Guide*
b. Giachino and Weeks, *Welding Skills and Practices*
c. Griffin, *Basic Oxtacetylene*
d. Althouse, *Modern Welding*
e. Oregon, *Welding*

Student Manuals:

Georgia, *Welding, Phase A*, Unit 10

Tools and Equipment:

a. Oxyacetylene welding apparatus
b. Two pieces of light gage sheet metal approximately 4" x 6", 1/16" or 3/32" filler rod

LAB HOURS	6
CLASS HOURS	10

EVALUATION (OXA-08)

Using oxyacetylene welding equipment, the student will produce two 4" x 6" plates of beads with a filler rod, with four beads 5" long on each plate. The beads must be straight, evenly spaced and conform to specifications.

TASK

OXA-09 Welding butt joints

PERFORMANCE OBJECTIVE

Weld butt joints.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Types and uses of butt joints
b. Edge preparation
c. Selection of filler rod
d. Welding technique
    1. Torch adjustment
    2. Torch angle and motion
    3. Correct use of the filler rod
e. Specifications for a good weld
f. Types of butt joint
    - Open
    - Closed
g. Terminology
    1. Crown
    2. Direction of weld or direction of travel

(Continued on back)

Provide Demonstration On:

a. Examples of good and bad butt welds
b. Proper welding techniques

Provide Practical Application On:

Welding a strong butt joint in the four welding positions

INSTRUCTIONAL MATERIALS

Textbooks:

a. Georgia, Welding, Instructor Guide
b. Giachino and Weeks, Welding Skills and Practices
c. Griffin, Basic Oxyacetylene
d. Althouse, Modern Welding
e. Oregon, Welding

A/Vs:

Georgia, Welding, "Welding in a Flat Position," slide/tape; "Vertical and Overhead Welding," slide/tape

Student Manual:

Georgia, Welding, Phase A, Units A-11 and A-12

Tools and Equipment:

a. Oxyacetylene apparatus
b. Steel filler rods
c. Mild steel plate of various gages

LAB HOURS	20
CLASS HOURS	10

EVALUATION (OXA-09)

a. Using oxyacetylene welding apparatus, the student will weld two butt joints on one side only. The plates will be approximately 4" wide and 5" long. The welds will be done in four positions (flat, horizontal, vertical, overhead). One joint will be bent in a vice to check penetration and fusion. All joints will be checked for appearance.

b. V'TECS, Welder, Tasks 18, 20, 21, 22, 23, 26, 29 and 34.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

h. Errors/causes
    1. Uneven weld bead/incorrect speed
    2. Holes in joint/holding flame in one spot too long
    3. Brittle weld/improper flame adjustment
    4. Excessive metal sag/too much penetration
    5. Insufficient penetration/too rapid torch speed
    6. Hole in end of joint/not lifting torch when end reached
    7. Weak joint even though have correct penetration
        - Holding torch too flat
        - Filling space with rod and not melting base metal sufficiently
        - Improper space between the edges of the plate

TASK

OXA-10 Welding lap joints

PERFORMANCE OBJECTIVE

Weld lap joints.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Definition of lap joint
b. Edge preparation
c. Positioning of metals
d. Selection of filler rod
e. Welding technique
    1. Torch adjustment
    2. Torch angle and motion
    3. Correct use of the filler rod
f. Specifications for a good weld
g. Errors and their causes

Provide Demonstration On:

a. Examples of good and bad lap joint welds
b. Proper welding technique

Provide Practical Application On:

Welding lap joints in the four positions using various gages of mild steel plate

INSTRUCTIONAL MATERIALS

Textbooks:

a. Georgia, Welding, Instructor Guide
b. Giachino and Weeks, Welding Skills and Practices
c. Griffin, Basic Oxyacetylene
d. Althouse, Modern Welding
e. Oregon, Welding

Student Manuals:

Georgia, Welding, Phase A, Unit 12

Tools and Equipment:

a. Oxyacetylene welding apparatus
b. Steel filler rod
c. Mild steel plate, various gages

LAB HOURS 20
CLASS HOURS 10

EVALUATION (OXA-10)

a. Using oxyacetylene welding apparatus, the student will weld lap joints in the horizontal, vertical, flat and overhead positions with proper surface appearance and complete root penetration. Joints must be 6" long and tested by bending in a vice to a 90° angle.

b. V'TECS, Welder, Task 24.

TASK

OXA-11 Welding T-joints

PERFORMANCE OBJECTIVE

Welt T-joints.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Types and uses of T-joints
b. Edge preparation
c. Positioning of metals
d. Selection of filler rod
e. Welding technique
    1. Torch adjustment
    2. Angle, motion and speed of torch
    3. Correct use of the filler rod
f. Specifications for a good weld
g. Errors and their causes

Provide Demonstration On:

a. Examples of good and bad T-joints and reasons for errors
b. Proper welding technique

Provide Practical Application On:

Welding T-joints in the four positions using various gages of mild steel plate

INSTRUCTIONAL MATERIALS

Textbooks:

a. Georgia, Welding, Instructor Guide
b. Giachino and Weeks, Welding Skills and Practices
c. Griffin, Basic Oxyacetylene
d. Althouse, Modern Welding
e. Oregon, Welding

A/Vs:

Georgia, Welding, "Welding T-Joints," slide/tape

Student Manuals:

Georgia, Welding, Phase A, Unit A-13

Tools and Equipment:

a. Oxyacetylene apparatus
b. Steel welding rods
c. Mild steel plates, various gages

LAB HOURS	25
CLASS HOURS	10

EVALUATION (OXA-11)

a. Given oxyacetylene welding equipment and appropriate materials, the student will weld T-joints in horizontal, vertical, flat and overhead positions using a filler rod. All welds should meet standards in clean appearance, uniform bead, equal distribution of metal on each surface and complete penetration and fusion. All welds will be bent and checked for penetration.

b. V'TECS, Welder, Task 17.

TASK

OXA-12 Setting up the oxyacetylene apparatus for flame cutting

PERFORMANCE OBJECTIVE

Set up the oxyacetylene apparatus for flame cutting.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. The principle of oxidation
   1. The effect on metals
   2. The effect of heat
   3. Ferrous metals
   4. Properties of different metals
   5. The effect of metal thickness

b. Cutting torches and apparatus
   1. Manual torch types
   2. Needle valves
   3. Cutting tips
   4. Care and maintenance of equipment

Provide Demonstration On:

Examples of different types of cutting torches and apparatus

Provide Practical Application On:

Selecting and setting up torches and equipment for a flame cutting job

INSTRUCTIONAL MATERIALS

Textbooks:

a. Georgia, *Welding, Instructor Guide*
b. Giachino and Weeks, *Welding Skills and Practices*
c. Griffin, *Basic Oxyacetylene*
d. Althouse, *Modern Welding*
e. Oregon, *Welding*

A/Vs:

Georgia, Welding, "The Flame Cutting Process," slide/tape

Student Manuals:

Georgia, *Welding, Phase A, Unit A-14*

Tools and Equipment:

One piece and combination oxyacetylene cutting torches and apparatus

LAB HOURS 2

CLASS HOURS 3

EVALUATION (OXA-12)

a. Given specifications for an oxyacetylene cutting job, the student will select the proper equipment and set up the apparatus for the job.

b. Test items are available in Welding, Instructor Guide, Vol. II, Test A-14.

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TASK

OXA-13 Cutting with an oxyacetylene cutting torch

PERFORMANCE OBJECTIVE

Cut with an oxyacetylene cutting torch.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

- a. Selecting the correct torch and apparatus
- b. Preparing metals
- c. Technique for cutting straight lines
- d. Cutting circles
  - 1. Freehand cutting
  - 2. Using an attachment
  - 3. Torch adjustment
  - 4. Angle, speed and motion of torch
  - 5. Punch marking lines
  - 6. Ring cutting
- e. Bevel cutting
  - 1. Tip size
  - 2. Using a guide bar
  - 3. Torch adjustment

(Continued on back)

Provide Demonstration On:

- a. Examples of good cuts
- b. Proper cutting techniques
- c. Errors and their causes

Provide Practical Application On:

- a. Setting up and lighting a torch
- b. Straight line cutting
- c. Bevel cutting
- d. Circle cutting
- e. Round stock cutting
- f. Proper cleaning of equipment

INSTRUCTIONAL MATERIALS

Textbooks:

- a. Georgia, Welding, Instructor Guide
- b. Giachino and Weeks, Welding Skills and Practices
- c. Griffin, Basic Oxyacetylene
- d. Althouse, Modern Welding
- e. Oregon, Welding

A/Vs:

Georgia, Welding, "Cutting a Straight Line," slide/tape

Student Manuals:

Georgia, Welding, Phase A, Unit A-15

Tools and Equipment:

- a. Oxyacetylene cutting apparatus
- b. Cutting attachment
- c. Various gages of mild steel plate, round solids and pipe

LAB HOURS	15
CLASS HOURS	5

EVALUATION (OXA-13)

a. Given an oxyacetylene cutting torch, measuring equipment and other proper materials and equipment, the student will
  a. Correctly set up and light a cutting torch
  b. Cut five straight, smooth strips of metal
  c. Cut a circle - should be perfectly round and smooth
  d. Cut a ring - should be round and smooth
  e. Cut a beveled edge
    1. Finished surface of edge should have perpendicular drag lines
    2. Top and bottom edge should be well defined
  f. Cut a section of a solid shaft
  g. Cut a section of pipe

  All cutting should have smooth clean appearance and be free of slag.

b. V'TECS, Welder, Task 43.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

  4. Angle, motion and speed of torch
  5. Degrees of beveling

f. Cutting round stock with the manual torch
  1. Torch adjustment
  2. Angle, motion and speed of torch
  3. Tip size for cutting
    - Pipe
    - Round solids
  4. Starting the cut

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TASK

OXA-14 Piercing and cutting holes

PERFORMANCE OBJECTIVE

Pierce and cut holes.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Procedures for piercing small holes
    1. Correct tip size
    2. Flame type
    3. Tip movement
    4. Obtaining desired hole diameter

b. Procedure for cutting larger holes
    1. Marking line to be cut
    2. Cutting small hole inside hole to be cut
    3. Cutting from small hole to cutting line
    4. Continuing around line
    5. Perpendicular tip angle to metal plate

(Continued on back)

Provide Demonstration On:

a. Proper piercing and cutting technique

b. Errors and their causes

Provide Practical Application On:

Piercing and cutting holes

1. Setting up equipment
2. Preparing metal and equipment for cutting
3. Laying out work
4. Lighting torch
5. Piercing and cutting proper holes

INSTRUCTIONAL MATERIALS

Textbooks:

a. Georgia, Welding, Instructor Guide

b. Giachino and Weeks, Welding Skills and Practices

c. Griffin, Basic Oxyacetylene

d. Althouse, Modern Welding

e. Oregon, Welding

A/Vs:

Georgia, Welding, "Cutting and Piercing Holes," slide/tape

Student Manuals:

Georgia, Welding, Phase A, Unit A-16

Tools and Equipment:

a. Oxyacetylene cutting apparatus

b. Mild steel plate, various gages

c. Assorted tools

LAB HOURS 9

CLASS HOURS 12

EVALUATION (OXA-14)

Given oxyacetylene hole cutting equipment and proper materials, the student will
a. Set up cutting equipment
b. Layout 3 holes 2" in diameter
c. Make smooth, slag free cuts

INSTRUCTIONAL ACTIVITIES

Provide Information On:

c. Alternate procedures for cutting large holes
d. Sizing holes accurately

TASK

OXA-15 Cutting with an automatic oxyacetylene cutting machine

PERFORMANCE OBJECTIVE

Cut with an automatic oxyacetylene cutting machine.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Types of machines
   1. For straight line cutting
   2. For shape cutting

b. Attachments to machines

c. Locating machines

d. Starting machine

e. Operating machine

f. Shutting down machine

g. Cutting procedure with machine

h. Travel speeds - chart

i. Cutting torch operating data - chart

(Continued on back)

Provide Demonstration On:

Operating the cutting machine and cutting a straight line, circle and a beveled edge

Provide Practical Application On:

a. Setting up cutting machine

b. Making a straight line cut

c. Making a beveled edge cut

d. Cutting a circle

INSTRUCTIONAL MATERIALS

Textbooks:

a. Georgia, Welding, Instructor Guide

b. Althouse, Modern Welding

c. Cutting machine manual

d. Oregon, Welding

A/Vs:

Georgia, "Setting Up the Automatic Cutting Machine," slide/tape

Student Manuals:

Georgia, Welding, Phase A, Unit A-17

Tools and Equipment:

a. Oxyacetylene straight line automatic cutting machine

b. Radius rod attachment

c. Mild steel plate, various gages

LAB HOURS	10
CLASS HOURS	5

EVALUATION (OXA-15)

Given a straight line automatic cutting machine and proper materials, the student will
a. Set up machine
b. Make three straight, smooth, slag free cuts
c. Insert radius rod
d. Cut out one smooth, slag free circle
e. Cut one smooth, even, beveled edge
f. Shut down machine

INSTRUCTIONAL ACTIVITIES

Provide Information On:

j. Cutting a straight line
  1. Assembling with correct torches and tips
  2. Starting machine - operating controls
k. Circle cutting - Inserting radius rod
l. Bevel cutting

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TASK

OXA-16 Welding beads with brass rods

PERFORMANCE OBJECTIVE

Weld beads with brass rods.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Definition of brazing
b. How brazing works
c. Repairing
d. Joining certain metals
  1. Cast iron
  2. Malleable brass
  3. Copper
  4. Steel tubing to cast iron
  5. Copper tubing to steel
  6. Tool steel to low carbon steel
e. Advantages and disadvantages
f. Purpose and use of flux
g. Tip selection
h. Brazing rod selection

(Continued on back)

Provide Demonstration On:

a. Examples of different uses of brazing
b. Proper brazing technique
c. Errors and their causes

Provide Practical Application On:

a. Brazing beads on steel plate
b. Brazing copper tubing to steel plate

INSTRUCTIONAL MATERIALS

Textbooks:

a. Georgia, Welding, Instructor Guide
b. Giachino and Weeks, Welding Skills and Practices
c. Griffin, Basic Oxyacetylene Welding
d. Althouse, Modern Welding
e. Oregon, Welding

A/Vs:

Georgia, "Running Beads With a Brass Rod," slide/tape

Student Manuals:

Georgia, Welding, Phase A, Unit A-18

Tools and Equipment:

a. Oxyacetylene welding apparatus
b. Flux coated brass rods
c. Mild steel plate 1/8" thick
d. Pieces of copper tubing

LAB HOURS	8
CLASS HOURS	8

EVALUATION (OXA-16)

a. Given oxyacetylene welding equipment and brass rods, the student will
   1. Set up welding equipment
   2. Run two 9" long beads on 2" wide steel plate according to proper specifications
   3. Make brazing welds as strong as the base metal

b. Written test items available in Welding, Instructor Guide, Vol. II, Test A-18.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

i. Brazing technique
   1. Torch adjustment
   2. Tinning
   3. Rod angle
   4. Torch angle, motion and speed
   5. Temperature control
j. Errors and their causes

TASK

OXA-17 Brazing a lap joint using oxyacetylene apparatus

PERFORMANCE OBJECTIVE

Braze a lap joint.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

Bronzing process
a. Tip selection
b. Tinning action
c. Control of flow of filler metal - flame angle
d. Types of filler metals
e. Cleaning surface to be welded

Provide Practical Application On:

Brazing a lap joint

Provide Practical Application On:

Welding unlike metals

INSTRUCTIONAL MATERIALS

Textbooks:

a. Georgia, Welding, Instructor Guide
b. Giachino and Weeks, Welding Skills and Practices
c. Griffin, Basic Oxyacetylene Welding
d. Althouse, Modern Welding
e. Oregon, Welding

Student Manuals:

Georgia, Welding, Phase A, Unit A-19

Tools and Equipment:

a. Oxyacetylene welding equipment
b. 3/32" or 1/8" flux coated brass rod
c. 4 pieces 1/16" or 1/8" steel 2" x 6"

LAB HOURS	15
CLASS HOURS	5

EVALUATION (OXA-17)

a. Given oxyacetylene welding equipment, flux coated brass rods and proper materials, the student will set up equipment and braze two joints with proper appearance. One joint will be checked for appearance and one joint will be checked by breaking for depth of bond.

b. Written items are available in Welding, Instructor Guide, Vol. II, Test A-19.

c. V'TECS, Welder, Task 40.

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TASK

OXA-18 Brazing with silver

PERFORMANCE OBJECTIVE

Braze with silver.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Grades of silver alloy
   1. Easy flow
   2. Medium flow
   3. Hard flow
b. Characteristics
   1. Low tensile strength
   2. Corrosion resistance
   3. High electrical conductivity
c. Silver alloys chart
   1. Composition
   2. Melting/flowing point
   3. Uses
   4. Special alloys

(Continued on back)

Provide Demonstration On:

a. Examples of good and bad brazing
b. Proper brazing procedures

Provide Practical Application On:

Silver brazing various metals and types of joints

INSTRUCTIONAL MATERIALS

Textbooks:

Oregon, Welding

Tools and Equipment:

a. Oxyacetylene welding apparatus
b. Parts to be brazed
c. Flux
d. Silver brazing filler metal (wire or ribbon)
e. Assorted tools

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LAB HOURS	15
CLASS HOURS	5

EVALUATION (OXA-18)

Given proper silver brazing materials and equipment, the student will braze a proper lap joint that has a good clean appearance and test the joint for strength.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

d. Uses of silver brazing
    1. Fastening carbide inserts
    2. Assembling computer parts
    3. Connecting pipe and tubing
    4. Assembling small stamped parts
    5. Fabricating firearm parts
    6. Jewelry and artwork
    7. Fabricating odd parts

e. Method of brazing
    1. Preparing metals
    2. Fluxing
    3. Flame adjustment
    4. Using the filler metal
    5. Using the torch

f. Toxic fumes

TASK

OXA-19 Soldering copper, sheet metal and other metals

PERFORMANCE OBJECTIVE

Solder copper, sheet metal and other metals.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Uses of soldering
b. Types of solder
    1. Tin and lead
    2. Silver
c. Types of fluxes and their uses
    1. Corrosive
    2. Non-corrosive
d. Advantages and disadvantages
e. Types of joints
    1. Tolerance
    2. Strength
    3. Joint design

(Continued on back)

Provide Demonstration On:

a. Examples of good soldered joints
b. Examples of soldering errors and their causes
c. Proper soldering techniques

Provide Practical Application On:

Soldering various metals and different kinds of joints using various types of solder

INSTRUCTIONAL MATERIALS

Textbooks:

a. Georgia, *Welding, Instructor Guide*
b. Althouse, *Modern Welding*
c. Oregon, *Welding*

A/Vs:

Georgia, "Silver Soldering Process," slide/tape

Student Manuals:

Georgia, *Welding, Phase A*, Unit A-20

Tools and Equipment:

a. Oxyacetylene welding equipment
b. Solder, various types
c. Flux
d. Various metals to be soldered
e. Assorted tools

LAB HOURS 15
CLASS HOURS 5

EVALUATION (OXA-19)

a. Given copper tubing, steel sheet metal, solder and oxyacetylene welding equipment, the student will solder two pieces of copper tubing to a piece of sheet metal. Joints must have an even bond around the tubing inside and outside the joint.

b. V'TECS, Welder, Task 50.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

f. Soldering equipment
    1. Soldering copper
    2. Electric soldering copper
    3. Electric soldering gun
    4. Gas furnaces for heating soldering coppers
    5. Propane torch

g. Cleaning and soldering a joint
    1. Heating the base metal
    2. Tinning a copper
    3. Fluxing
    4. Applying solder

h. Soldering technique
    1. Soldering seams
    2. Sweat soldering
    3. Wire connections

TASK

OXA-20 Welding cast iron

PERFORMANCE OBJECTIVE

Weld cast iron.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Preparation of casting
    1. Remove "Casting Skin"
    2. Grinding a V
b. Welding process
    1. Fusion - heat metal to melting point to start weld
    2. Flame - neutral
    3. Flux
    4. Angle and motion of torch
c. Post heat and cooling process
d. Errors and their causes

Provide Practical Application On:

Welding a cast iron butt joint

INSTRUCTIONAL MATERIALS

Textbooks:

a. Georgia, Welding, Instructor Guide
b. Giachino and Weeks, Welding Skills and Practices
c. Althouse, Modern Welding

A/Vs:

Georgia, "Welding in Cast Iron," slide/tape

Student Manuals:

Georgia, Welding, Phase A, Unit A-21

Tools and Equipment:

a. Oxyacetylene welding apparatus
b. Two pieces of cast iron
c. Cast iron filler rod with flux
d. Assorted tools

LAB HOURS	6
CLASS HOURS	4

EVALUATION (OXA-20)

Given the necessary tools and equipment, the student will weld a cast iron butt joint. The completed task must be free of errors.

TASK

OXA-21 Cutting and welding pipe

PERFORMANCE OBJECTIVE

Cut and weld pipe.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Method for cutting pipe
    1. Wrapping around - to maintain straight line
    2. Marking pipe with soap stone
    3. Centering punch on line every 1/2"
    4. Using channel
    5. Proper tip sizes
    6. Torch angle and motion
    7. Flame - neutral
    8. Pipe cutting technique
b. Beveling pipe
c. Selecting filler rod

(Continued on back)

Provide Demonstration On:

a. Examples of good welds
b. Examples of errors and their causes
c. Proper welding technique

Provide Practical Application On:

Cutting pipe and making a butt weld

INSTRUCTIONAL MATERIALS

Textbooks:

a. Georgia, Welding, Instructor Guide
b. Giachino and Weeks, Welding Skills and Practices
c. Althouse, Modern Welding
d. Oregon, Welding

A/Vs:

Georgia, "Pipe Welding," slide/tape

Student Manuals:

Georgia, Welding, Phase A, Unit A-22

Tools and Equipment:

a. Oxyacetylene welding apparatus
b. Filler rod
c. Pieces of pipe
d. Assorted tools

LAB HOURS	15
CLASS HOURS	5

EVALUATION (OXA-21)

a. Given oxyacetylene welding equipment, pipes and other proper equipment, the student will make butt welds on pipe 2" and smaller in the rolled and fixed position.

b. V'TECS, Welder, Task 83.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

d. Welding pipe
    1. Preparing and positioning pieces of pipe
    2. Rolling method
    3. Angle and motion of torch
    4. Using the filler rod

TASK

ARC-01 Selecting and setting up shielded arc welding apparatus

PERFORMANCE OBJECTIVE

Select and set up shielded arc welding apparatus.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Shielded arc welding terminology
b. Safety regulations and practices
c. What to do in case of accident
d. Types and characteristics of arc welding machines and their applications
e. Welding circuits and currents
   1. AC/DC
   2. Amps, volts, ohms
   3. Polarity
   4. Grounding
f. Accessories and protective clothing

(Continued on back)

Provide Demonstration On:

a. Types of welding machines and accessories
b. Safe and unsafe practices

Provide Practical Application On:

a. Setting up proper welding circuits
b. Identifying and selecting electrodes

INSTRUCTIONAL MATERIALS

Textbooks:

a. Georgia, *Welding, Instructor Guide*
b. Giachino and Weeks, *Welding Skills and Practices*
c. Althouse, *Modern Welding*
d. Oregon, *Welding*
e. Griffin, *Basic Arc Welding*

A/Vs:

Georgia, "Introduction to Shielded Arc Welding," slide/tape; "Shielded Arc Welding," slide/tape; "Identification of

(Continued on back)

Student Manuals:

Georgia, *Welding, Phase B*, Units B-1, B-2, B-3, B-4A, B-5, B-6 and B-9

Tools and Equipment:

a. Several types of shielded arc welding machines
b. Arc welding face shield

(Continued on back)

LAB HOURS 10
CLASS HOURS 5

EVALUATION (ARC-01)

a. Given a set of job specifications, the student will correctly select and set up the proper arc welding apparatus for performing the job, including selection of the proper electrodes and setting up the welding circuit.

b. Georgia, Welding, Instructor Guide, Vol. II, Tests B-1, B-2, B-4A, B-4B and B-5.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

g. Procedures for setting up apparatus
h. Types of electrodes, their characteristics and uses
    1. Electrode identification and operating data chart
    2. AWS classification system for mild and low alloy steel electrodes
i. Selecting the correct electrode
    1. Finished produce specifications
    2. Job conditions and requirements
    3. The effects of current
    4. Properties of metals being welded

INSTRUCTIONAL MATERIALS

A/Vs:

Arc Welding Machines," slide/tape; "Electrical Circuits," slide/tape; "Setting Up Welding Machine and Striking an Arc," slide/tape; "Identifying and Selecting Electrodes," slide/tape

Tools and Equipment:

c. Variety of electrodes
d. Chipping hammer
e. Wire brush
f. Soap stone

TASK

ARC-02 Welding string and weaving beads

PERFORMANCE OBJECTIVE

Weld string and weave beads.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Uses of string and weave beads
b. Selection of electrode
c. Setting of polarity and amperage
d. Preparation of metals
    1. Cleaning
    2. Laying out lines
    3. Clamping, bracing
e. Setting up circuit
f. Method of welding
    1. Striking an arc
    2. Angle of electrode
    3. Arc length
    4. Motion of electrode
    5. Direction of travel and speed
    6. Tacking

(Continued on back)

Provide Demonstration On:

a. The correct appearance of properly welded string and weave beads
b. Recognizing faulty welding and its cause

Provide Practical Application On:

Welding beads in all four positions using various types of electrodes and metals

INSTRUCTIONAL MATERIALS

Textbooks:

a. Georgia, Welding, Instructor Guide
b. Giachino and Weeks, Welding Skills and Practices
c. Oregon, Welding
d. Griffin, Basic Arc Welding

A/Vs:

Georgia, "Weld String and Weave Beads in the Overhead Position," slide/tape

Student Manuals:

Georgia, Welding, Phase B, Units B-23, B-24, B-34, B-37

Tools and Equipment:

a. AC/DC welding machine
b. Protective clothing
c. Cleaning tools
d. Pliers or vise grips
e. Various electrodes
f. Various gages of mild steel plate

LAB HOURS	15
CLASS HOURS	5

EVALUATION (ARC-02)

Given various gages of mild steel plate and arc welding apparatus, the student will set up the equipment, select the proper electrode and weld a series of string and weave beads on plates in the four welding positions of flat, horizontal, vertical and overhead.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

g. Standard for weld
    1. Bead width
    2. Rippling
    3. Uniformity
h. Errors and their causes
    1. Cold start
    2. Burn through
    3. Spattering
    4. Too high crown
    5. Break in arc
i. Cleaning finished work
j. Differences in welding procedures for flat, horizontal, vertical and overhead welding positions
k. Welding characteristics of different gage metals

TASK

ARC-03 Arc welding string beads and padding a plate

PERFORMANCE OBJECTIVE

Arc weld string beads and pad a plate.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Definitions
   1. Padding a plate
   2. Beads
   3. Wash beads
   4. Tolerance
   5. Shelf
   6. Sagging
   7. Undercutting
b. Method of making a pad of beads
   1. Motion of weld
   2. Welding in the four positions of flat, horizontal, vertical and overhead

(Continued on back)

Provide Practical Application On:

Welding a pad of beads
a. Welding in all four positions
b. Using E6010, E6011 and E6013 electrodes

INSTRUCTIONAL MATERIALS

Textbooks:

a. Georgia, Welding, Instructor Guide
b. Giachino and Weeks, Welding Skills and Practices
c. Althouse, Modern Welding
d. Oregon, Welding
e. Griffin, Basic Arc Welding

A/Vs:

Georgia, "Welding a Part of Beads in the Flat Position," slide/tape; "Padding a Plate of Beads in the Horizontal

(Continued on back)

Student Manuals:

Georgia, Welding, Phase B, Units B-7, B-12, B-16, B-18

Tools and Equipment:

a. AC/DC welding machine
b. Protective clothing
c. Cleaning tools
d. Pliers or vice grips
e. 1/8" E6010, E6011, E6013 electrodes
f. 1/4" mild steel plates 5" x 8"

LAB HOURS	10
CLASS HOURS	5

EVALUATION (ARC-03)

Given shielded arc welding equipment and other proper materials, the student will weld a pad of beads in all four welding positions. The beads should have proper width, evenness and uniformity, no cold starts, proper crater filling, correct overlapping and no sag or undercut.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

c. Adjusting machine
    1. Electrode types (particularly E6010, E6011 and E6013 electrodes)
    2. Thickness of metal
d. Cleaning work

INSTRUCTIONAL MATERIALS

A/Vs:

Position," slide/tape; "Padding a Plate in the Vertical Position," slide/tape

TASK

ARC-04 Arc welding lap joints

PERFORMANCE OBJECTIVE

Arc weld lap joints.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Lap joints
    1. Edge preparation
    2. Positioning of metals
    3. Leg dimensions
b. Bead form for lap joints
c. Method for welding various gages of metals
    1. Electrode selection
    2. Welding together two different gages of metals
    3. Welding together the same gage of metal
    4. Where to direct arc
d. Welding positions
    1. Flat
    2. Horizontal

(Continued on back)

Provide Demonstration On:

a. Examples of good lap joint welds
b. Errors and their causes
c. Proper welding techniques

Provide Practical Application On:

a. Examples of good lap joint welds
b. Errors and their causes
c. Proper welding techniques

INSTRUCTIONAL MATERIALS

Textbooks:

a. Georgia, Welding, Instructor Guide
b. Althouse, Modern Welding
c. Oregon, Welding
d. Schell and Matlock, Industrial Welding Procedures
e. Griffin, Basic Arc Welding

A/Vs:

Georgia, "Welding a Lap Joint in the Horizontal Position," slide/tape

Student Manuals:

Georgia, Welding, Phase B, Units B-10, B-14, B-20, B-25, B-36, B-39

Tools and Equipment:

a. Shield arc welding machine
b. Protective clothing
c. Cleaning tools

(Continued on back)

LAB HOURS	10
CLASS HOURS	5

EVALUATION (ARC-04)

a. Given shielded arc welding equipment and other proper materials, the student will
    1. Weld lap joints
        - Weld in the four welding positions
        - Weld the joint using two different gages of metal to weld together
        - Weld different gages of metal, but weld the same gage together
    2. Joint should have
        - Proper penetration and fusion
        - Complete fill
        - Equal leg dimensions
        - Proper beads
        - Clean, neat appearance

b. V'TECS, Welder, Task 24.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

    3. Vertical
    4. Overhead
e. Welding method for the four positions
    1. Motion of electrode
    2. Torch angle and motion
    3. Machine settings
    4. Travel speed
f. Welding with different electrodes
    1. Method of selection and identification
    2. Machine settings
    3. Current
    4. Travel speed
    5. Types of metals used with electrodes
    6. Electrode widths
g. Errors
    1. Weld sag
    2. Undercut
    3. Burn through
h. Testing weld joints
    1. Guided bend testing
    2. Acid etching
    3. Destructive tests
    4. X-ray tests
    5. Visual tests

INSTRUCTIONAL MATERIALS

Tools and Equipment:

d. Pliers and vice grips
e. Electrodes E6010, E6011, E6012, E6013, E6024, E7024, E7018
f. Light and medium gage metal

TASK

ARC-05 Arc welding butt joints

PERFORMANCE OBJECTIVE

Arc weld butt joints.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Types of butt joints
   1. Square butt
   2. Square groove
   3. Single V groove
   4. Double V groove
   5. Single bevel groove
   6. Double bevel groove
   7. Single U groove
   8. Double U groove
   9. Single J groove
   10. Double J groove
b. Edge preparation
c. Root opening
d. Bead form and sequence
e. Back up bar
f. Welding different gages of metals

(Continued on back)

Provide Demonstration On:

a. Different types of electrodes and their uses with butt joints
b. Examples of good butt joint welds
c. Examples of poor butt joint welds and the causes

Provide Practical Application On:

Welding butt joints in the four positions using different metals and different electrodes

INSTRUCTIONAL MATERIALS

Textbooks:

a. Giachino and Weeks, Welding Skills and Practices
b. Althouse, Modern Welding
c. Oregon, Welding
d. Schell and Matlock, Industrial Welding Procedures
e. Georgia, Welding, Instructor Guide
f. Griffin, Basic Arc Welding

A/Vs:

Georgia, "Welding Butt Joints in the Flat Position," slide/tape

Student Manuals:

Georgia, Welding, Phase B, Units B-8, B-13, B-17, B-19, B-24, B-27, B-30, B-32, B-35 and B-38

Tools and Equipment:

a. Shielded arc welding machine and apparatus
b. Protective clothing

(Continued on back)

LAB HOURS	15
CLASS HOURS	5

EVALUATION (ARC-05)

a. Given a shielded arc welding machine and related apparatus and tools, the student will weld various types of square and grooved butt joints in the four positions of flat, horizontal, vertical and overhead, using E6010, E6011, E6012, E6013, E6024, E7018 and E7024 electrodes and various gages of metals. All joints will be free of errors and poor welds.

b. V'TECS, Welder, Tasks 18, 20, 21, 22 and 23.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

g. Welding in different positions
    1. Flat
    2. Horizontal
    3. Vertical
    4. Overhead
h. Welding techniques
    1. Motion of electrode
    2. Electrode angle
    3. Direction of travel
    4. Machine settings
    5. Arc length
i. Errors and their causes
    1. Weld sag
    2. Undercut
    3. Spattering
    4. Cold start
    5. Burn through
j. Using different electrodes
    1. Machine settings
    2. Travel speed
    3. Electrode diameter
    4. Machine with metals
    5. Welding with E6010, E6011, E6012, E6013, E6024, E7018 and E7024 electrodes
k. Testing weld joints
l. Characteristics of good joints

INSTRUCTIONAL MATERIALS

Tools and Equipment:

c. Assorted tools
d. Electrodes E6010, E6011, E6012, E6013, E6024, E7018, E7024
e. Steel plates of mild steel, light gage

TASK

ARC-06 Shield arc welding T-fillet joints

PERFORMANCE OBJECTIVE

Shield arc weld T-fillet joints.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Terminology
    1. Fillet joint
    2. T-fillet joint
    3. Root beads
    4. Weave beads
    5. Multiple passes
    6. Keyhole effect
b. Welding techniques
    1. Machine setting
    2. Electrode angle
    3. Electrode motion
    4. Arc length
    5. Speed of travel
    6. Direction of travel

(Continued on back)

Provide Demonstration On:

a. Examples of properly welded joints
b. Examples of por welding and the causes

Provide Practical Application On:

Welding T-joints in the four welding positions using various metals and various electrodes

INSTRUCTIONAL MATERIALS

Textbooks:

a. Giachino and Weeks, Welding Skills and Practices
b. Althouse, Modern Welding
c. Oregon, Welding
d. Schell and Matlock, Industrial Welding Procedures
e. Georgia, Welding, Instructor Guide
f. Griffin, Basic Arc Welding

Student Manuals:

Georgia, Welding, Phase B
Units B-11, B-15, B-21, B-22,
B-26, B-31 and B-33

Tools and Equipment:

a. AC/DC welding machine and apparatus
b. Protective clothing

(Continued on back)

LAB HOURS 15

CLASS HOURS 5

EVALUATION (ARC-06)

a. Given an AC/DC shielded arc welding machine, related apparatus and tools, the student will weld T-fillet joints in the flat, horizontal, vertical and overhead positions using various gages of mild steel plate and a variety of different electrodes. All welds will exhibit the characteristics of a good weld and will be free of errors.

b. V'TECS, Welder, Task 17.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

c. Selection of electrodes
d. Low hydrogen electrodes
e. Bead type and distribution
f. Welding in different positions
g. Errors and their causes

INSTRUCTIONAL MATERIALS

Tools and Equipment:

c. Assorted tools
d. Electrodes E6010, E6011, E6013, E7018 and E7024
e. Various gages of mild steel plate

TASK

ARC-07 Testing arc welded joints

PERFORMANCE OBJECTIVE

Test arc welded joints.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Conducting the break test
b. Characteristics of a good break
    1. Face smooth and regular
    2. Complete fusion, full penetration
    3. No undercutting
    4. No slag or gas pockets in weld
c. Conducting the guided bend test
    1. Face bend
    2. Root bend
d. Characteristics of a good bend
    1. No cracks or breaks
    2. Complete fusion

(Continued on back)

Provide Demonstration On:

a. Conducting joint tests
b. Examples of good welds

Provide Practical Application On:

a. Conducting break and bend tests
b. Conducting sawed cross-section test
c. Conducting chisel test

INSTRUCTIONAL MATERIALS

Textbooks:

a. Giachino and Weeks, Welding Skills and Practices
b. Griffin, Basic Arc Welding
c. Althouse, Modern Welding
d. Oregon, Welding
e. Georgia, Welding, Instructor Guide

Student Manuals:

Georgia, Welding, Phase B, Unit B-40

Tools and Equipment:

a. Arc welded T-joints
b. Arc welded butt joints
c. Pliers, vice grips, bench vice
d. Hacksaw
e. Hammer, chisels, punch

LAB HOURS	6
CLASS HOURS	4

EVALUATION (ARC-07)

a. Given an AC/DC shielded arc welding machine, electrodes, metal plates and assorted tools, the student will weld several T-joints and V-groove butt joints and will test the joints using break tests, bend tests, saw tests and chisel tests.

b. V'TECS, Welder, Task 29.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

e. Conducting a sawed cross-section test
f. Conducting a chisel test

TASK

AC-01 Identifying major components and functions of air conditioning systems

PERFORMANCE OBJECTIVE

Identify major components and functions of air conditioning systems.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Window units
b. Split systems
c. Package systems
d. Hydronic systems
e. Solar systems
f. Methods of heat removal
    1. Convection
    2. Radiation
    3. Evaporation
g. Factors effecting comfort
    1. Temperature
    2. Humidity
    3. Cleanliness
    4. Distribution
h. Tables of comfort zones

Provide Demonstration On:

a. Use of amprobe
b. Use of VOM

Provide Practical Application On:

a. Inspecting various types of systems and components
b. Recording nameplate data to gain familiarity with equipment

INSTRUCTIONAL MATERIALS

Textbooks:

a. Delmar, Principles of Air Conditioning
b. Althouse, Modern Refrigeration and Air Conditioning
c. Prentice-Hall, Refrigeration and Air Conditioning

A/Vs:

Georgia, "Demonstrate a Knowledge of Air Conditioning Systems," slide/tape AC-01a

Student Manuals:

Georgia, Air Conditioning, Unit AC-01

Tools and Equipment:

a. Window units
b. Central system components
c. Hydronic system
d. Solar components

LAB HOURS	4
CLASS HOURS	6

EVALUATION (AC-01)

a. When presented with the various components and systems covered in this unit, the student will correctly identify all equipment and accurately describe the function of each major component.

b. Georgia, Electro-Mechanical, Instructor Guide; Vol. IV, 1980.

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TASK

AC-02 Applying basic air principles

PERFORMANCE OBJECTIVE

Apply basic air principles.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Basic psychrometric chart
b. Basic text for psychrometric chart
c. Principles of psychrometrics
    1. Wet bulb
    2. Dry bulb
    3. Relative humidity
    4. Dew point
    5. Grains of moisture
d. Sample problems to locate unknown properties of psychrometric chart

Provide Demonstration On:

a. Use of psychrometric chart
b. How to plot unknown properties on the chart

Provide Practical Application On:

Reading wet and dry bulb temperatures using a sling psychrometer

INSTRUCTIONAL MATERIALS

Textbooks:

a. Delmar, Principles of Air Conditioning
b. Althouse, Modern Refrigeration and Air Conditioning
c. Prentice-Hall, Refrigeration and Air Conditioning
d. Carrier Corp., Carrier Manual

A/Vs:

Georgia, "Applying Basic Air Principles," slide/tape AC-02a

Student Manuals:

Georgia, Air Conditioning, Unit AC-02

Tools and Equipment:

a. Psychrometric chart
b. Sling psychrometer
c. Wet bulb and dry bulb thermometers

LAB HOURS	4
CLASS HOURS	6

EVALUATION (AC-02)

a. Being familiar with the definition of psychrometric terms and the psychrometric chart, the student will plot unknown values on the chart.

b. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

TASK

AC-03 Calculating heat loads

PERFORMANCE OBJECTIVE

Calculate heat loads.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Terminology of graphs and charts
b. Reading dimensions from floor plans
c. Use of Manual "J" tables to find total heat loss for a given room or residence

Provide Demonstration On:

a. Heat flow resistance
b. Reading graphs and tables

Provide Practical Application On:

Calculating heat loss and heat gain from a house plan

INSTRUCTIONAL MATERIALS

Textbooks:

a. Delmar, Principles of Air Conditioning
b. Prentice-Hall, Refrigeration and Air Conditioning

A/Vs:

Georgia, "Calculating Heat Loads," slide/tape AC-03a

Student Manuals:

Georgia, Air Conditioning, Unit AC-03

Tools and Equipment:

House floor plan

LAB HOURS 15

CLASS HOURS 5

EVALUATION (AC-03)

a. Given a residence floor plan, the student will use tables and charts to find the total heat loss for a given conditioned space.

b. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

TASK

AC-04 Applying principles of air movement

PERFORMANCE OBJECTIVE

Apply principles of air movement.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. The function of a duct system
b. Measuring air velocity
    1. Static pressure
    2. Velocity pressure
    3. Total pressure
    4. CFM
c. Measurement instruments
    1. U-tube manometer
    2. Anemometer
d. Duct system design

Provide Demonstration On:

a. Use of the manometer
b. Use of the anemometer

Provide Practical Application On:

a. Taking static pressure readings using the manometer
b. Taking total pressure readings
c. Calculating feet per minute air flow using the anemometer

INSTRUCTIONAL MATERIALS

Textbooks:

a. Delmar, Principles of Air Conditioning
b. Prentice-Hall, Refrigeration and Air Conditioning

A/Vs:

Georgia, "Applying Principles of Air Movement," slide/tape AC-04

Student Manuals:

Georgia, Air Conditioning, Unit AC-04

Tools and Equipment:

a. Operational duct work
b. U-tube manometer
c. Anemometer
d. Stop watch

LAB HOURS 10

CLASS HOURS 5

EVALUATION (AC-04)

a. Given an operational duct system, the student will correctly measure static, velocity and total pressures and will calculate CFM using correct meters and procedures.

b. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

TASK

AC-05 Servicing air filtering systems

PERFORMANCE OBJECTIVE

Service air filtering systems.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Purpose of filtering
b. Various types of filters
    1. Wet
    2. Dry
c. Location of filters
d. When and how to remove and replace dirty filters
e. Electronic air cleaners
    1. Ionizing electrostatic
    2. Charge media

Provide Demonstration On:

a. Types of filters
b. The effect of a dirty filter on air flow

Provide Practical Application On:

a. Servicing both a throw-away filter and a cleanable metal filter
b. Operating and troubleshooting an electronic air filtering system

INSTRUCTIONAL MATERIALS

Textbooks:

a. Delmar, Principles of Air Conditioning
b. Althouse, Modern Refrigeration and Air Conditioning
c. Prentice-Hall, Refrigeration and Air Conditioning

A/Vs:

Georgia, "Identifying Air Filtering Systems," slide/tape AC-05a

Student Manuals:

Georgia, Air Conditioning, Unit AC-05

Tools and Equipment:

a. Filters
b. Hand tools
c. Air conditioning systems
d. Electronic air filtering equipment

LAB HOURS	10
CLASS HOURS	5

EVALUATION (AC-05)

a. Given a variety of air conditioning equipment, the student will correctly remove and replace or clean and replace air filters.

b. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

TASK

AC-06 Installing condensate drains

PERFORMANCE OBJECTIVE

Install condensate drains.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. The function of a condensate drain
b. Design considerations
c. The importance of traps
d. Cutoff switches
e. Gravity flow and lift pumps
f. Use of plastic pipe
g. Use of metal pipe
h. Fittings and joints

Provide Demonstration On:

Types of condensate drains

Provide Practical Application On:

a. Designing drains for different types of air conditioning units
b. Installing a condensate drain

INSTRUCTIONAL MATERIALS

Textbooks:

a. Delmar, Principles of Air Conditioning
b. Althouse, Modern Refrigeration and Air Conditioning

A/Vs:

Georgia, "Installing Condensate Drain," slide/tape AC-13a

Student Manuals:

Georgia, Air Conditioning, Unit AC-13

Tools and Equipment:

a. PVC or plastic drain pipe and fittings
b. Condensate pump
c. Evaporator unit
d. Assorted tools
e. PVC pipe glue

LAB HOURS 4
CLASS HOURS 6

EVALUATION (AC-06)

a. Given a heating/air conditioning unit of the upflow design, the student will design and install a condensate drain with an overflow cutoff switch and lift pump.

b. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

TASK

AC-07 Installing residential and mobile home package air conditioning units

PERFORMANCE OBJECTIVE

Install residential and mobile home package air conditioning units.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Types of design
b. Air and water cooled
c. Site selection
d. Ducts and air registers
e. Air and service clearances
f. Foundation and mounting
g. Condensate drain
h. Flashing
i. Insulation
j. Vapor barriers
k. Charging the system

Provide Demonstration On:

a. Examples of typical installations
b. Special problems that may be encountered

Provide Practical Application On:

a. Having the student install a residential unit
b. Having the student install a mobile home unit

INSTRUCTIONAL MATERIALS

Textbooks:

a. Delmar, Principles of Air Conditioning
b. Althouse, Modern Refrigeration and Air Conditioning
c. Prentice-Hall, Refrigeration and Air Conditioning

A/Vs:

Georgia, "Installing Package Unit (Residential and Mobile Home)," slide/tape AC-14a

Student Manuals:

Georgia, Air Conditioning, Unit AC-14

Tools and Equipment:

a. Residential package air conditioner unit
b. Mobile home package air conditioner unit
c. Duct materials
d. Wiring materials
e. Refrigerant
f. Assorted hand tools and supplies

LAB HOURS	4
CLASS HOURS	6

EVALUATION (AC-07)

a. Given the appropriate equipment and supplies, the student will install, charge and connect a residential and a mobile home package air conditioning unit according to manufacturer's instructions and standard practice. The installed units will be fully operational.

b. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

TASK

AC-08 Installing split system air conditioning units

PERFORMANCE OBJECTIVE

Install split system air conditioning units.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Components of a split system
b. Zoning ordinances
c. Noise control
d. Installing the condenser
    1. Location
    2. Foundation
    3. Refrigeration lines
    4. Wiring
    5. Testing the charge
e. Installing the connecting lines
    1. Soft copper tubing
    2. Hard copper tubing (precautions)
    3. Type of solder

(Continued on back)

Provide Demonstration On:

a. Types of split systems and their components
b. Typical installation procedures

Provide Practical Application On:

Installing a complete split system

INSTRUCTIONAL MATERIALS

Textbooks:

a. Delmar, Principles of Air Conditioning
b. Althouse, Modern Refrigeration and Air Conditioning
c. Prentice-Hall, Refrigeration and Air Conditioning
d. Doolin, Doolin's Troubleshooter's Bible

A/Vs:

Georgia, "Installing Split System," slide/tape AC-15a

Student Manuals:

Georgia, Air Conditioning, Unit AC-15

Tools and Equipment:

a. Condensing unit
b. Evaporator unit with coil section
c. Line set
d. Freon
e. Assorted tools
f. Wiring

LAB HOURS 4

CLASS HOURS 6

EVALUATION (AC-08)

a. Given a split air conditioning system, appropriate supplies and tools, the student will install, wire and charge (as necessary) the system according to manufacturer's specifications and standard practice so that the unit is fully operational.

b. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

    4. Soft, pre-charged tubing
    5. Use of filter-driers
f. Installing the inside unit
g. Wiring the system
h. The thermostat
i. Fuses

TASK

AC-09 Installing add-on split air conditioning systems

PERFORMANCE OBJECTIVE

Install add-on split air conditioning systems.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Installing the outside unit
   1. Zoning ordinances
   2. Noise control
   3. Location
   4. Foundation
   5. Refrigerant lines
   6. Wiring
   7. Testing the charge

b. Installing the indoor unit
   1. Matching to existing equipment
   2. Power wiring and disconnect
   3. Thermostat
   4. Condensate drain
   5. Filters

(Continued on back)

Provide Demonstration On:

a. Types of add-on systems
b. Properly installed systems

Provide Practical Application On:

Installing an add-on split system

INSTRUCTIONAL MATERIALS

Textbooks:

a. Althouse, *Modern Refrigeration and Air Conditioning*
b. Delmar, *Principles of Air Conditioning*
c. Prentice-Hall, *Refrigeration and Air Conditioning*
d. Doolin, *Doolin's Troubleshooter's Bible*

A/Vs:

Georgia, "Installing Add-on Split Systems," slide/tape AC-16a

Student Manuals:

Georgia, *Air Conditioning*, Unit AC-16

Tools and Equipment:

a. Add-on split system components
b. Refrigerant tubing
c. Wiring
d. Refrigerant and gauges
e. Assorted tools
f. Upflow type furnace

LAB HOURS	4
CLASS HOURS	6

EVALUATION (AC-09)

a. Given an upflow or a counter flow type furnace, add-on split system air conditioning components, appropriate tools and supplies, the student will install the add-on split system air conditioning components, including wiring and charging the system according to the manufacturer's specifications, so that the system is fully operational.

b. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

c. Installing the connecting tubing
d. Checking the charge

TASK

AC-10 Troubleshooting compressor burnout

PERFORMANCE OBJECTIVE

Troubleshoot compressor burnout.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Mechanical and electrical causes of burnout
b. Finding electrical problems
    1. Power supply
    2. Control circuit
    3. Internal overload
    4. Starting components
    5. Low voltage
    6. Run capacitor
    7. Fan motor
    8. Compressor circuits
c. Finding mechanical problems
    1. High and low side pressure

(Continued on back)

Provide Demonstration On:

a. Testing a motor-compressor electrically
b. Diagnosing mechanical failures
c. Cleanout procedures after burnout

Provide Practical Application On:

a. Diagnosing various types of compressor burnout
b. Removing and replacing a burned out compressor

INSTRUCTIONAL MATERIALS

Textbooks:

a. Delmar, Principles of Air Conditioning
b. Althouse, Modern Refrigeration and Air Conditioning
c. Prentice-Hall, Refrigeration and Air Conditioning
d. Doolin, Doolin's Troubleshooter's Bible

A/Vs:

Georgia, "Troubleshooting Compressor Burnout," slide/tape AC-17a

Student Manuals:

Georgia, Air Conditioning, Unit AC-17

Tools and Equipment:

a. Burned out compressor
b. Air conditioning unit
c. Replacement compressor
d. Vacuum pump, freon, gauges, manifold
e. VOM, Volt-amp meter
f. Assorted tools

LAB HOURS	4
CLASS HOURS	6

EVALUATION (AC-10)

a. Given the necessary tools and equipment, the student will accurately diagnose various types of compressor burnout and will remove and replace a compressor in an air conditioning unit, including evacuating and charging, so that the unit is fully operational.

b. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

2. Vacuum efficient test
3. Oil level
4. Oil acid test
5. Fan motor restriction
6. Condenser restriction
7. Unusual noises

d. Replacing a burned out compressor
e. Flushing the system
f. Installing a new filter-drier
g. Leak checking
h. Evacuating the system
i. Charging the system
j. Checking performance

TASK

AC-11 Troubleshooting fans and fan motors

PERFORMANCE OBJECTIVE

Troubleshoot fans and fan motors.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Types and characteristics of fan motors
    1. Shaded pole motor
    2. Split phase motor
    3. Capacitor start motor (CS)
    4. Permanent split capacitor motor (PSC)
    5. Capacitor start/run motor (CSR)
    6. Three phase motor
b. Diagnosing problems
    1. Voltage
    2. Electrical connections
    3. Starting components
    4. Motor windings

(Continued on back)

Provide Demonstration On:

a. Different types of motors
b. Diagnostic techniques
c. Typical types of motor failure

Provide Practical Application On:

Diagnosing, removing and replacing motors from evaporators and condensers

INSTRUCTIONAL MATERIALS

Textbooks:

a. Delmar, Principles of Air Conditioning
b. Althouse, Modern Refrigeration and Air Conditioning
c. Prentice-Hall, Refrigeration and Air Conditioning
d. Doolin, Doolin's Troubleshooter's Bible

A/Vs:

Georgia, "Troubleshooting Fans and Fan Motors," slide/tape AC-18a

Student Manuals:

Georgia, Air Conditioning, Unit AC-18

Tools and Equipment:

a. Electrically and mechanically faulty fan motors
b. Evaporator and condenser, replacement motors
c. VOM, amprobe
d. Assorted tools

LAB HOURS	4
CLASS HOURS	6

EVALUATION (AC-11)

a. Given the necessary tools and equipment, the student will accurately diagnose different types of mechanical and electrical failure in evaporator and condenser fans and fan motors and will remove and replace a fan motor from a condenser and an evaporator so that the unit is fully operational.

b. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

5. Bearings
6. Mounting blots
7. Blades
8. Pulleys and belts

c. Removing and replacing motor

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TASK

AC-12 Performing pre-season start-up and air conditioner service

PERFORMANCE OBJECTIVE

Perform pre-season start-up and air conditioner service.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. When and why perform pre-season start-up
b. Servicing the outside unit
    1. Voltage check
    2. Check F.L.A.
    3. Check for loose connections
    4. Compressor oil level
    5. Check freon charge
    6. Leak check
    7. Low and high side pressures
    8. Oil condenser fan motor

(Continued on back)

Provide Demonstration On:

Pre-season start-up procedures

Provide Practical Application On:

Giving complete pre-season start-up service on an air conditioning split unit

INSTRUCTIONAL MATERIALS

Textbooks:

a. Delmar, Principles of Air Conditioning
b. Althouse, Modern Refrigeration and Air Conditioning
c. Prentice-Hall, Refrigeration and Air Conditioning
d. Doolin, Doolin's Troubleshooter's Bible

A/Vs:

Georgia, "Performing Pre-Season Start-Up," slide/tape AC-19a

Student Manuals:

Georgia, Air Conditioning, Unit AC-19

Tools and Equipment:

a. Air conditioning system
b. VOM, amprobe
c. Freon, gauges
d. Assorted tools

LAB HOURS	4
CLASS HOURS	6

EVALUATION (AC-12)

a. Given an air conditioning system, service equipment and tools, the student will perform pre-season maintenance according to procedures covered in this unit.

b. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

    9. Checking air flow across
c. Servicing the inside unit
    1. Voltage check
    2. Check fan motor amps, running
    3. Belt tension and condition
    4. Fan motor lubrication
    5. Check air filter
    6. Check fan blades
    7. Check for loose electrical connections
    8. Evaporator air flow
    9. Temperature drop across evaporator
    10. Condensate pump
    11. Functioning of thermostat

TASK

AC-13 Troubleshooting air conditioner refrigeration cycle

PERFORMANCE OBJECTIVE

Troubleshoot air conditioner refrigeration cycle.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Troubleshooting from symptoms
b. Types of compressor failure
    1. Bearing failure
    2. Improper lubrication
    3. Faulty reed valves
c. Refrigerant leaks
d. Metering device malfunction
e. Low charge
f. High charge
g. Non-condensables
h. Determining proper charge
    1. Weigh in method
    2. Ambient temperature method

(Continued on back)

Provide Demonstration On:

a. Proper use of manifold and gauges in charging
b. Detecting a low and a high charge

Provide Practical Application On:

Charging a system using the four different methods

INSTRUCTIONAL MATERIALS

Textbooks:

a. Delmar, Principles of Air Conditioning
b. Althouse, Modern Refrigeration and Air Conditioning
c. Prentice-Hall, Refrigeration and Air Conditioning
d. Doolin, Doolin's Troubleshooter's Bible

A/Vs:

Georgia, "Troubleshooting Air Conditioners (Refrigeration Cycle)," slide/tape AC-20a and AC-20b

Student Manuals:

Georgia, Air Conditioning, Unit AC-20

Tools and Equipment:

a. Air conditioning systems with refrigeration cycle mechanical faults
b. Freon, manifold, gauges
c. VOM, Amprobe
d. Thermometers
e. Assorted tools

LAB HOURS	4
CLASS HOURS	6

EVALUATION (AC-13)

a. When presented with air conditioning systems having various mechanical faults in the refrigeration cycle, the student will accurately diagnose the malfunctions and will carry out the necessary repairs so that the systems are fully operational.

b. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

3. Evaporator temperature drop method
4. Superheat method

TASK

AC-14 Troubleshooting air conditioner electrical cycle

PERFORMANCE OBJECTIVE

Troubleshoot air conditioner electrical cycle.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Diagnosing by symptom
b. Checking incoming voltage and wiring
c. Testing air conditioner electrical components
    1. Circuit breaker
    2. Contactor
    3. Fan relay
    4. Transformer
    5. Capacitors
    6. Thermostat
    7. Fan motor
    8. Motor-compressor

Provide Demonstration On:

Correct use of meters for test of components

Provide Practical Application On:

Diagnosing and repairing various electrical problems in air conditioning units

INSTRUCTIONAL MATERIALS

Textbooks:

a. Delmar, Principles of Air Conditioning
b. Althouse, Modern Refrigeration and Air Conditioning
c. Prentice-Hall, Refrigeration and Air Conditioning
d. Doolin, Doolin's Trouble-shooter's Bible

Student Manuals:

Georgia, Air Conditioning, Unit AC-21

Tools and Equipment:

a. Air conditioning systems with faults in the electrical cycle
b. VOM, amprobe
c. Replacement parts
d. Assorted tools

LAB HOURS	4
CLASS HOURS	6

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EVALUATION (AC-14)

a. When presented with air conditioning systems having various faults in the electrical cycles, the student will accurately diagnose the electrical malfunctions and will carry out the necessary repairs so that the systems are fully operational.

b. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

TASK

AC-15 Troubleshooting air conditioner air movement

PERFORMANCE OBJECTIVE

Troubleshoot air conditioner air movement.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Diagnosis by symptom
b. Types of condensers
  1. Air cooled
  2. Round air cooled
  3. Shell and coil water cooled
  4. Shell and tube water cooled
  5. Double pipe water cooled
  6. Evaporative condenser
c. Typical condenser problems
  1. Air flow blockage
  2. Freon leaks

(Continued on back)

Provide Demonstration On:

a. Types of condensers and evaporators
b. Typical problems encountered
c. Repair of typical problems

Provide Practical Application On:

Diagnosing and repairing problems in different types of condensers and evaporators

INSTRUCTIONAL MATERIALS

Textbooks:

a. Delmar, Principles of Air Conditioning
b. Althouse, Modern Refrigeration and Air Conditioning
c. Prentice-Hall, Refrigeration and Air Conditioning
d. Doolin, Doolin's Troubleshooter's Bible

A/Vs:

Georgia, "Troubleshooting Air Conditioners (Air Movement)," slide/tape AC-22a and AC-22b

Student Manuals:

Georgia, Air Conditioning Unit AC-22

Tools and Equipment:

a. Various types of air conditioning systems
b. Air meter (F.P.M.)
c. Assorted tools

LAB HOURS	4
CLASS HOURS	6

EVALUATION (AC-15)

a. When provided with various types of air conditioning systems with air flow problems, the student will accurately diagnose and repair the problems so that the units are fully operational.

b. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

    3. Installation location
    4. Cooling capacity load
    5. Water flow blockage (water cooled)
    6. Water leaks (water cooled)
d. Types of evaporators
    1. "A" coil
    2. "H" coil
    3. Sloped coil
    4. Hydronic coil systems
e. Evaporator problems
    1. Freon leaks
    2. Dirty filters or improper filters
    3. Ice accumulation

TASK

AC-16 Applying principles of the heat pump

PERFORMANCE OBJECTIVE

Apply principles of the heat pump.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Principles of heat pump operation
b. How the refrigerant reverses cycle
c. Evaporator and condenser
d. Four way valve
e. The cooling cycle
f. The heating cycle
g. Types of heat pumps

Provide Demonstration On:

Heat pump components and their functions in the system

Provide Practical Application On:

Identifying and inspecting heat pump components

INSTRUCTIONAL MATERIALS

Textbooks:

a. Prentice-Hall, *Refrigeration and Air Conditioning*
b. Althouse, *Modern Refrigeration and Air Conditioning*
c. Delmar, *Principles of Air Conditioning*

A/Vs:

Georgia, "Understanding Principles of the Heat Pump," slide/tape AC-23a

Student Manuals:

Georgia, *Heat Pumps*, Unit AC-23

Tools and Equipment:

a. Various types of heat pumps
b. Heat pump components

LAB HOURS 4

CLASS HOURS 6

EVALUATION (AC-16)

The student will correctly identify different types of heat pumps, their components and the flow of refrigerant through the cooling cycle and heating cycle.

TASK

AC-17 Evacuating and charging a heat pump

PERFORMANCE OBJECTIVE

Evacuate and charge a heat pump.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Single stage and two-stage vacuum pumps
b. Purpose of evacuation
c. Evacuation procedure
d. Removing moisture and acid
e. Charging procedures
f. Determining proper freon charge
g. Various charging charts

Provide Demonstration On:

a. Proper evacuating and charging procedures
b. Troubleshooting techniques

Provide Practical Application On:

a. Evacuating and charging a heat pump
b. Diagnosing charge problems

INSTRUCTIONAL MATERIALS

Textbooks:

a. Prentice-Hall, Refrigeration and Air Conditioning
b. Althouse, Modern Refrigeration and Air Conditioning
c. Delmar, Principles of Air Conditioning

Student Manuals:

Georgia, Heat Pumps, Unit AC-24

Tools and Equipment:

a. Heat pump
b. Manifold and gauge set
c. Vacuum pump and gauge
d. Freon
e. Assorted tools

LAB HOURS	4
CLASS HOURS	6

EVALUATION (AC-17)

Given a heat pump and proper tools and equipment, the student will triple-evacuate and recharge the system according to specification.

TASK

AC-18 Installing a reversing valve

PERFORMANCE OBJECTIVE

Install a reversing valve.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Function of the reversing valve
b. Testing the operation of the reversing valve
c. Purpose and operation of the pilot solenoid
d. Removal and replacement procedures
e. Troubleshooting techniques

Provide Demonstration On:

Proper testing, removal and replacement procedures

Provide Practical Application On:

Testing, removing and replacing a reversing valve

INSTRUCTIONAL MATERIALS

Textbooks:

a. Prentice-Hall, Refrigeration and Air Conditioning
b. Delmar, Principles of Air Conditioning

Student Manuals:

Georgia, Heat Pumps, Unit AC-25

Tools and Equipment:

a. Reversing valve
b. Heat pump system
c. Torch and solder
d. Vacuum pump and gauges
e. Manifold and gauge set
f. Freon
g. Leak detector
h. Assorted tools

LAB HOURS	4
CLASS HOURS	6

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EVALUATION (AC-18)

Given a heat pump, a reversing valve and appropriate tools and equipment, the student will install the reversing valve and evacuate and recharge the system so that the heat pump is fully operational.

TASK

AC-19 Tracing the heat pump refrigeration cycle

PERFORMANCE OBJECTIVE

Trace the heat pump refrigeration cycle.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Each component in the refrigeration cycle
b. Condition of the freon at each point in the cycle
c. The inside and outside coils during heating and cooling
d. Troubleshooting techniques

Provide Demonstration On:

Diagrams of heat pump operation during heating and cooling

Provide Practical Application On:

Identifying and inspecting operation of components during heating and cooling

INSTRUCTIONAL MATERIALS

Textbooks:

a. Prentice-Hall, Refrigeration and Air Conditioning
b. Althouse, Modern Refrigeration and Air Conditioning
c. Delmar, Principles of Air Conditioning

A/Vs:

Georgia, "Refrigeration Cycle and Components," slide/tape AC-26a

Student Manuals:

Georgia, Heat Pumps, Unit AC-26

Tools and Equipment:

Operational heat pump

LAB HOURS	4
CLASS HOURS	6

EVALUATION (AC-19)

Given an operational heat pump, the student will trace the operation of the components through the heating and cooling cycle.

TASK

AC-20 Installing electrical circuits

PERFORMANCE OBJECTIVE

Install electrical circuits.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Schematic wiring diagrams for heat pumps
b. Different types of design
c. Line voltage
d. Low voltage
e. Supplement heat
f. Guard circuits
g. Thermostats
h. Wiring installation techniques
i. Diagnosing problems

Provide Demonstration On:

a. Schematic wiring diagrams
b. Techniques of installation
c. Testing and troubleshooting

Provide Practical Application On:

a. Reading schematics
b. Wiring a heat pump unit
c. Diagnosing and repairing wiring problems

INSTRUCTIONAL MATERIALS

Textbooks:

a. Prentice-Hall, Refrigeration and Air Conditioning
b. Althouse, Modern Refrigeration and Air Conditioning
c. Delmar, Principles of Air Conditioning

A/Vs:

Georgia, "Inspecting Electrical Circuits," slide/tape AC-27a

Student Manuals:

Georgia, Heat Pumps, Unit AC-27

Tools and Equipment:

a. Schematics
b. Heat pumps
c. Wiring supplies
d. Assorted hand tools

LAB HOURS	4
CLASS HOURS	6

EVALUATION (AC-20)

Given an unwired heat pump, a wiring schematic and appropriate supplies, tools and equipment, the student will properly wire the unit and components according to the schematic and manufacturer's specifications.

TASK

AC-21 Adjusting and repairing defrost controls

PERFORMANCE OBJECTIVE

Adjust and repair defrost controls.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. The cause of frosting
b. Three basic steps of the defrost cycle
c. Methods of frost detection
d. Adjusting and repairing defrost controls
e. Different methods of defrost
f. Troubleshooting techniques

Provide Demonstration On:

a. Sequence of operation on several types of frost detection devices
b. Adjustment and repair procedures

Provide Practical Application On:

a. Using different frost detection methods
b. Adjusting and repairing defrost controls

INSTRUCTIONAL MATERIALS

Textbooks:

a. Prentice-Hall, Refrigeration and Air Conditioning
b. Althouse, Modern Refrigeration and Air Conditioning
c. Delmar, Principles of Air Conditioning

A/Vs:

Georgia, "Adjusting and Repairing Defrost Controls," slide/tape AC-28a

Student Manuals:

Georgia, Heat Pumps, Unit AC-28

Tools and Equipment:

a. Heat pumps with different types of defrost methods
b. Assorted tools

LAB HOURS	2
CLASS HOURS	4

EVALUATION (AC-21)

Given various types of heat pumps with malfunctioning defrost control devices, the student will adjust or repair the defrost controls so that the systems are fully operational.

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TASK

AC-22 Installing package heat pumps

PERFORMANCE OBJECTIVE

Install package heat pumps.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Design of package units
b. Types of package units
c. Air flow systems
d. Supplementary heat coil installation
e. Installation techniques
f. Piping
g. Electrical connectors
h. Diagnosing problems

Provide Demonstration On:

a. Different types of packing units
b. Proper installation techniques

Provide Practical Application On:

Installing, wiring and troubleshooting package units

INSTRUCTIONAL MATERIALS

Textbooks:

a. Prentice-Hall, Refrigeration and Air Conditioning
b. Althouse, Modern Refrigeration and Air Conditioning
c. Delmar, Principles of Air Conditioning

A/Vs:

Georgia, "Installing Package Heat Pumps," slide/tape AC-29a

Student Manuals:

Georgia, Heat Pumps, Unit AC-29

Tools and Equipment:

a. Package heat pumps
b. Copper tubing and fittings
c. Torch and solder
d. Freon, leak detector, vacuum pump
e. Assorted tools, gauges and instruments

LAB HOURS	9
CLASS HOURS	3

EVALUATION (AC-22)

a. Given a package heat pump and proper tools and equipment, the student will install the unit according to manufacturer's specifications. The unit must be fully operational.

b. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

TASK

AC-23 Installing split-system heat pumps

PERFORMANCE OBJECTIVE

Install a split-system heat pump.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. System components
b. Indoor unit
c. Outdoor unit
d. Connecting tubing
e. Electrical controls
f. Outside unit location
g. Use of silver solder
h. Duct work requirements
i. Power wiring and fusing
j. Thermostat
k. Charging the system

Provide Demonstration On:

a. Types of split-system components
b. Proper installation techniques
c. Troubleshooting techniques

Provide Practical Application On:

Installing, wiring and troubleshooting a split-system heat pump

INSTRUCTIONAL MATERIALS

Textbooks:

a. Prentice-Hall, Refrigeration and Air Conditioning
b. Althouse, Modern Refrigeration and Air Conditioning
c. Delmar, Principles of Air Conditioning

A/Vs:

Georgia, "Installing Split System Heat Pumps," slide/tape AC-30a

Student Manuals:

Georgia, Heat Pumps, Unit AC-30

Tools and Equipment:

a. Split-system heat pump
b. Assorted hand tools, gauges and instruments
c. Copper tubing and fittings
d. Torch and solder
e. Freon, leak detector, vacuum pump

LAB HOURS	9
CLASS HOURS	3

EVALUATION (AC-23)

a. Given a split-system heat pump system and proper tools and equipment, the student will install, charge and wire the system according to manufacturer's specifications. The pump system must be fully operational.

b. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

TASK

HE-01 Applying principles of electric furnaces and controls

PERFORMANCE OBJECTIVE

Apply principles of electric furnaces and controls.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Power sources
b. Transformers
c. Thermostats
d. Heating elements
e. Sequencers
f. Sequence of operation
g. Fan motors
h. Limit controls
i. Fusible links
j. Fan relays
k. Operation of heating systems

Provide Demonstration On:

Checking the operation of a system using proper test instruments

Provide Practical Application On:

Inspecting various types of furnaces in operation

INSTRUCTIONAL MATERIALS

Textbooks:

a. Althouse, Modern Refrigeration and Air Conditioning
b. Cooper, Warm Air Heating for Climate Control
c. Manufacturer's instruction and operation manuals

A/Vs:

Georgia, "Applying Principles of Electric Furnaces and Controls," slide/tape HE-01

Student Manuals:

Georgia, Heating, Unit HE-01

Tools and Equipment:

a. Furnaces
b. Test meters
c. Assorted tools

LAB HOURS 4

CLASS HOURS 6

EVALUATION (HE-01)

a. Given an electric furnace, the student will list all components and their purpose of operation.

b. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

TASK

HE-02 Installing electric furnaces

PERFORMANCE OBJECTIVE

Install electric furnaces.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Positioning of electric furnaces
b. Furnace clearance
c. Type of thermostat and wiring
d. Type and size of power wiring
e. Checking manufacturing installation instructions
f. Reading wiring diagrams
g. Local and state codes

Provide Demonstration On:

Proper and improper installation techniques

Provide Practical Application On:

a. Positioning furnaces
b. Checking clearances
c. Connecting to duct work
d. Pulling and connecting power sources
e. Installing thermostats and connections
f. Testing units for proper operation

INSTRUCTIONAL MATERIALS

Textbooks:

a. Prentice-Hall, Refrigeration and Air Conditioning
b. Althouse, Modern Refrigeration and Air Conditioning
c. Cooper, Warm Air Heating for Climate Control
d. Manufacturer's installation instructions

Student Manuals:

Georgia, Heating, Unit HE-02

Tools and Equipment:

a. Furnace unit
b. Sheet metal tools
c. Assorted tools
d. Wiring for line and control

LAB HOURS	6
CLASS HOURS	6

EVALUATION (HE-02)

a. Given an electric furnace and proper tools and equipment, the student will install an electric furnace according to manufacturer's specifications and local and state codes.

b. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

TASK

HE-03 Troubleshooting electric furnaces

PERFORMANCE OBJECTIVE

Troubleshoot electric furnaces.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Troubleshooting from symptoms
b. Incoming voltage and wiring
c. Circuit breaker or fuse
d. Reading schematics
e. Thermostat operation
f. First sequencer
g. First heater
h. Limit switch
i. Pulling the heater strip
j. The fusible link
k. Second and third sequencer
l. Second and third heater

Provide Demonstration On:

a. An electric furnace in operation
b. Troubleshooting a furnace by the process of elimination and sequence of operation

Provide Practical Application On:

Diagnosing and repairing various problems in different types of electric furnaces

INSTRUCTIONAL MATERIALS

Textbooks:

a. Manufacturer's instructions for electric furnaces
b. Cooper, Warm Air Heating for Climate Control

A/Vs:

Georgia, "Troubleshooting Electric Furnaces," slide/tape HE-03

Student Manuals:

Georgia, Heating, Unit HE-03

Tools and Equipment:

a. Different types of electric furnaces having various malfunctions
b. Test meters
c. Replacement parts
d. Assorted hand tools

LAB HOURS	6
CLASS HOURS	4

EVALUATION (HE-03)

a. Given several electric furnaces with different malfunctions, the student will correctly diagnose and repair the problems so that the units are fully operational.

b. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

TASK

HE-04 Applying gas fuel combustion and safety principles

PERFORMANCE OBJECTIVE

Apply gas fuel combustion and safety principles.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Natural gas
b. Liquid petroleum
c. Mixed gas
d. Carbon monoxide
e. Manufactured gas
f. Specific gravity
g. Explosive limits
h. Checking for leaks
    1. Odor
    2. Corrosion in gas lines
    3. Using soap bubbles
i. Procedures to follow if gas leak is suspected
j. Venting procedures
k. Fire safety codes

Provide Demonstration On:

a. Using the pressure test gauge
b. Using a combustion test kit
c. Checking for leaks

Provide Practical Application On:

a. Testing a gas furnace and related piping for leaks
b. Adjusting a furnace to insure proper combustion
c. Demonstrating venting procedures

INSTRUCTIONAL MATERIALS

Textbooks:

a. Althouse, Modern Refrigeration and Air Conditioning
b. Carrier, Gas Piping and Combustion
c. Cooper, Warm Air Heating for Climate Control

A/Vs:

Georgia, "Applying Gas Fuel Combustion and Safety Principles," slide/tape HE-04a

Student Manuals:

Georgia, Heating, Unit HE-04

Tools and Equipment:

a. Pressure test gauge
b. Combustion test kit
c. Different types of gas furnaces
d. Soap bubbles
e. Assorted tools

LAB HOURS 2
CLASS HOURS 6

EVALUATION (HE-04)

a. Given a gas furnace and test equipment, the student will test the gas pressure in the system, test the combustion and use the soap bubble test for leaks.

b. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

TASK

HE-05 Identifying major components and functions of gas heating systems

PERFORMANCE OBJECTIVE

Identify major components and functions of gas heating systems.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Components of gas furnaces
   1. Gas valves
   2. Pressure regulator
   3. Pilot safety
   4. Burner assembly
   5. Heat exchanger
   6. Draft hood
   7. Basso switch
   8. Controls
   9. Fan motor
   10. Thermocouple
   11. Heat exchanger
   12. Flue
b. Types of furnaces
   1. Downflow
   2. Upflow
   3. Horizontal
   4. Low boy
c. Testing instruments

Provide Demonstration On:

a. The function of each component
b. Using test instruments to test each component

Provide Practical Application On:

Testing each component on a operational furnace

INSTRUCTIONAL MATERIALS

Textbooks:

a. Cooper, Warm Air Heating Climate Control
b. Carrier Heating Manual

A/Vs:

Georgia, "Understanding Basic Gas Systems," slide/tape HE-05a and HE-05b

Student Manuals:

Georgia, Heating, Unit HE-05

Tools and Equipment:

a. Voltmeter
b. Ohmmeter
c. Small hand tools
d. Water manometer

LAB HOURS 4

CLASS HOURS 6

EVALUATION (HE-05)

When presented with the various gas furnace components and systems covered in this unit, the student will correctly identify all equipment and accurately describe the function of each unit and component.

TASK

HE-06 Checking gas sources

PERFORMANCE OBJECTIVE

Check gas sources.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Slack tube manometer
b. Bacharach manometer
c. Dial manometer
d. Installing manometers
e. Reading manometers
f. Checking gas flow and BTU imput
g. Reading gas meters
h. Problems with gas meters

Provide Demonstration On:

a. Hooking up a water manometer
b. Reading a gas meter and determining hourly gas input

Provide Practical Application On:

a. Adjusting appliance regulator
b. Determining cubic feet consumed per hour

INSTRUCTIONAL MATERIALS

Textbooks:

a. Althouse, Modern Refrigeration and Air Conditioning
b. Carrier Heating Manual

A/Vs:

Georgia, "Checking Gas Sources," slide/tape HE-06

Student Manuals:

Georgia, Heating, Unit HE-06

Tools and Equipment:

a. Watch with minute hand
b. Water manometer
c. Small hand tools
d. Operational gas furnace

LAB HOURS	4
CLASS HOURS	6

EVALUATION (HE-06)

a. Given an operational gas furnace, appropriate tools and equipment, the student will determine the rate of gas flow.

b. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

TASK

HE-07 Applying gas piping principles

PERFORMANCE OBJECTIVE

Apply gas piping principles.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Factors that determine pipe size
    1. Allowable pressure loss
    2. Maximum consumption
    3. Length of pipe and fittings
    4. Specific gravity of the gas
    5. Diversity factor
b. Types of pipe material
    1. Black iron
    2. Galvinized
    3. Copper
    4. Aluminum
c. Installation methods

Provide Demonstration On:

a. Threading pipe
b. Rise in horizontal runs
c. Using pipe dope
d. Drip leg
e. Proper fittings

Provide Practical Application On:

a. Sizing a gas piping system
b. Properly installing a gas piping system

INSTRUCTIONAL MATERIALS

Textbooks:

a. Copper, Warm Air Heating for Climate Control
b. Carrier Heating Manual

A/Vs:

Georgia, "Gas Piping Principles," slide/tape HE-07

Student Manuals:

Georgia, Heating, Unit HE-07

Tools and Equipment:

a. Gas piping and fitting
b. Pipe cutter and threading tools
c. Pipe wrenches
d. Small hand tools

LAB HOURS	4
CLASS HOURS	6

EVALUATION (HE-07)

a. Given the BTU input of gas heating systems, the student will calculate size and properly install gas house piping.

b. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

TASK

HE-08 Installing and adjusting gas regulators

PERFORMANCE OBJECTIVE

Install and adjust gas pressure regulators.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Identifying component parts of a pressure regulator
b. Function of each component
c. Purpose of regulators
d. Installation procedures
e. Sizing a regulator

Provide Demonstration On:

a. Removing, disassembling and repairing a regulator
b. Installing and adjusting a pressure regulator

Provide Practical Application On:

a. Disassembling and reassembling a gas pressure regulator
b. Sizing a regulator

INSTRUCTIONAL MATERIALS

Textbooks:

a. Cooper, Warm Air Heating for Climate Control
b. Carrier Heating Manual

A/Vs:

Georgia, "Adjusting Regulators," slide/tape HE-08

Student Manuals:

Georgia, Heating, Unit HE-08

Tools and Equipment:

a. Pipe wrenches
b. Water manometer
c. Small hand tools
d. Regulators
e. Gas heating system

LAB HOURS	4
CLASS HOURS	6

EVALUATION (HE-08)

a. Given a gas pressure regulator and water manometer, the student will properly install and adjust the gas pressure regulator.

b. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

TASK

HE-09 Installing and servicing gas valves

PERFORMANCE OBJECTIVE

Install and service gas valves.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Solenoid valve
b. Diaphragm valve
c. Bimetal valve
d. Heat motor valve
e. Function of valves
f. Installation procedures
g. Diagnosing problems
h. Servicing procedures
i. Testing for leaks

Provide Demonstration On:

a. An operating gas valve
b. Installation procedures

Provide Practical Application On:

Removing, disassembling, reassembling, reinstalling and testing a gas valve

INSTRUCTIONAL MATERIALS

Textbooks:

a. Cooper, Warm Air Heating for Climate Control
b. Carrier Heating Manual

A/Vs:

Georgia, "Installing and Servicing Gas Valves," slide/tape HE-09

Student Manuals:

Georgia, Heating, Unit HE-09

Tools and Equipment:

a. Pipe wrenches
b. Small hand tools
c. Volt-ohmmeter
d. Soap bubbles
e. Water manometer
f. Various types of gas valves
g. Gas heating system

LAB HOURS	4
CLASS HOURS	6

EVALUATION (HE-09)

a. Given the proper tools and equipment, the student will remove, repair, replace and properly troubleshoot a gas valve on a gas heating system.

b. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

TASK

HE-10 Installing and servicing pilot ignition devices

PERFORMANCE OBJECTIVE

Install and service pilot ignition devices.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Components of a pilot ignition system and their function
b. Pilot burner
c. Direct spark ignition
d. Glow coil
e. Spark ignition of a pilot
f. Diagnosing problems
g. Hazards with pilot systems
h. Installation procedures for a pilot ignition system

Provide Demonstration On:

a. Installing a pilot ignition
b. Proper and improper pilot ignition operation

Provide Practical Application On:

Installing a pilot ignition system

INSTRUCTIONAL MATERIALS

Textbooks:

a. Althouse, *Modern Regrigeration and Air Conditioning*
b. Cooper, *Warm Air Heating for Climate Control*
c. *Carrier Heating Manual*

A/Vs:

Georgia, "Installing and Servicing Pilot Ignition Devices," slide/tapes HE-10a and HE-10b

Student Manuals:

Georgia, *Heating*, Unit HE-10

Tools and Equipment:

a. Small hand tools
b. Soap bubbles
c. Millivolt tester
d. Pilot ignition system
e. Gas heating system

LAB HOURS	4
CLASS HOURS	6

EVALUATION (HE-10)

Given an operational gas furnace, the student will properly remove and replace a pilot ignition system so that the furnace is fully operational.

TASK

HE-11 Installing and servicing combination gas valves

PERFORMANCE OBJECTIVE

Install and service combination gas valves.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Components of combination gas valves and their functions
b. Diagnosing malfunctions
c. Installing a combination gas valve
d. Testing a combination gas valve
    1. Leaks
    2. Safety drop time
    3. Manifold pressure
    4. Control circuit amp draw

Provide Demonstration On:

Installation of a combination gas valve

Provide Practical Application On:

a. Diagnosing problems in a combination gas valve
b. Replacing combination gas valves

INSTRUCTIONAL MATERIALS

Textbooks:

a. Althouse, Modern Refrigeration and Air Conditioning
b. Cooper, Warm Air Heating for Climate Control
c. Carrier Heating Manual

A/Vs:

Georgia, "Installing and Servicing Combination Gas Valves," slide/tapes HE-11a and HE-11b

Student Manuals:

Georgia, Heating, Unit HE-11

Tools and Equipment:

a. Pipe wrenches
b. Small hand tools
c. Millivolt meter
d. Volt-ohmmeter
e. Water manometer
f. Combination gas valve
g. Gas heating system

LAB HOURS	4
CLASS HOURS	6

EVALUATION (HE-11)

a. Given a combination gas valve, proper tools and equipment, the student will install the valve on an operational gas furnace, check for leaks, set to proper pressure and troubleshoot gas valve problems.

b. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

TASK

HE-12 Servicing gas burners

PERFORMANCE OBJECTIVE

Service gas burners.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Types of burners
b. Recognizing proper and improper flames
c. Procedure for removing a burner
d. Diagnosing burner malfunctions
e. Installing burners
f. Types of burners
g. Burner adjustment

Provide Demonstration On:

a. Different types of burners
b. Removing and installing burners
c. Adjusting the burner flame

Provide Practical Application On:

a. Installing a gas burner
b. Adjusting and testing burners
c. Diagnosing malfunctions and making repairs

INSTRUCTIONAL MATERIALS

Textbooks:

a. Cooper, Warm Air Heating for Climate Control
b. Carrier Heating Manual

A/Vs:

Georgia, "Servicing Gas Burners," slide/tape HE-12

Student Manuals:

Georgia, Heating, Unit HE-12

Tools and Equipment:

a. Small hand tools
b. Flashlight
c. Pipe wrench
d. Wire brush
e. Orifice drill set
f. Burner
g. Operational gas furnace

LAB HOURS 4
CLASS HOURS 6

EVALUATION (HE-12)

a. Given an operational gas furnace, the student will properly remove, service and replace a burner assembly to operate properly when completed.

b. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

TASK

HE-13 Inspecting and adjusting temperature rise of heat exchangers

PERFORMANCE OBJECTIVE

Inspect and adjust temperature rise of heat exchangers.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Types of heat exchangers
b. Effect of gas pressure and CFM of air on temperature rise
c. Determining temperature rise
d. Diagnosing problems in heat exchangers
e. Causes of improper temperature rise
f. Correcting problems in heat exchangers
g. Hazards of defective heat exchangers

Provide Demonstration On:

Inspecting temperature rise in an operating furnace

Provide Practical Application On:

a. Diagnosing various malfunctions in a heat exchanger
b. Adjusting furnace for proper temperature rise

INSTRUCTIONAL MATERIALS

Textbooks:

a. Cooper, Warm Air Heating for Climate Control
b. Carrier Heating Manual

A/Vs:

Georgia, "Inspecting and Determining Temperature Rise of Heat Exchangers," slide/tape HE-13

Student Manuals:

Georgia, Heating, Unit HE-13

Tools and Equipment:

a. Thermometers
b. Small hand tools
c. Water manometers
d. Operational gas furnace
e. Heat exchangers

LAB HOURS	4
CLASS HOURS	6

EVALUATION (HE-13)

a. Given an operational gas furnace, the student will inspect the heat exchanger for defects, adjust primary air and gas pressure and insure proper temperature rise.

b. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

TASK

HE-14 Venting gas heating systems

PERFORMANCE OBJECTIVE

Vent gas heating systems.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Function of a venting system
b. Hazards of improper venting
c. Diagnosing improper venting
d. Combustion grills and method of rating grill size
e. Determining cubic feet of combustion air and free area of grills
f. Individual venting
g. Determining vent size
h. Venting for primary and secondary air
i. Installing a venting system

Provide Demonstration On:

Proper venting procedures

Provide Practical Application On:

a. Selecting material for vents
b. Determining vent size for various conditions
c. Installing a venting system on a warm air furnace
d. Testing a venting system on a warm air furnace

INSTRUCTIONAL MATERIALS

Textbooks:

a. Prentice-Hall, Refrigeration and Air Conditioning
b. Carrier Heating Manual

Student Manuals:

Georgia, Heating, Unit HE-14

Tools and Equipment:

a. Small hand tools
b. Wooden matches
c. Steel tape measure
d. Sheet metal screws
e. Operational gas furnace
f. Vent pipe and venting materials

LAB HOURS	4
CLASS HOURS	6

EVALUATION (HE-14)

a. Given an operational gas furnace, the student will calculate size and properly install the vent on a gas furnace.

b. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

TASK

HE-15 Servicing gas furnace electrical controls

PERFORMANCE OBJECTIVE

Service gas furnace electrical controls.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Thermostat
b. Fan relay
c. Fan limit
d. Fan switch
e. Two speed fan motors
f. Low voltage transformer
g. Wiring, line and low voltage
h. Function of each component
i. Diagnosing problems

Provide Demonstration On:

Electrical controls of operational furnace

Provide Practical Application On:

a. Wiring electrical components of a gas heating system
b. Diagnosing and repairing various malfunctions

INSTRUCTIONAL MATERIALS

Textbooks:

a. Cooper, Warm Air Heating for Climate Control
b. Carrier Heating Manual

A/Vs:

Georgia, "Servicing Electrical Controls," slide/tape HE-15

Student Manuals:

Georgia, Heating, Unit HE-15

Tools and Equipment:

a. Small hand tools
b. Volt-ohmmeter
c. Millivolt meter
d. Amprobe
e. Functional gas furnace

LAB HOURS	4
CLASS HOURS	6

EVALUATION (HE-15)

a. Given an operational gas furnace, the student will diagnose and service all the electrical controls.

b. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

TASK

HE-16 Determining combustion efficiency

PERFORMANCE OBJECTIVE

Determine combustion efficiency.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Using a test kit
b. Proper combustion
c. Testing for proper combustion
d. Making adjustments to achieve proper combustion

Provide Demonstration On:

a. Use of a combustion test kit
b. Testing the combustion efficiency on a operating furnace

Provide Practical Application On:

a. Testing an operating furnace for proper combustion using a test kit
b. Making various adjustments to produce the highest efficiency in the system

INSTRUCTIONAL MATERIALS

Textbooks:

a. Cooper, Warm Air Heating for Climate Control
b. Carrier Heating Manual

A/Vs:

Georgia, "Determining Combustion Efficiency," slide/tape HE-16

Student Manuals:

Georgia, Heating, Unit HE-16

Tools and Equipment:

a. Combustion test kit with operating instructions
b. Small hand tools
c. Operational gas furnace

LAB HOURS	2
CLASS HOURS	6

EVALUATION (HE-16)

a. Given an operational gas furnace and combustion efficiency test kit, the student will determine the combustion efficiency and adjust the furnace for maximum combustion efficiency.

b. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

TASK

HE-17 Performing a pre-season check-up and start-up on a gas furnace.

PERFORMANCE OBJECTIVE

Perform a pre-season check-up on a gas furnace.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Venting
b. Air filters
c. Blower belt
d. Blower motor and blade
e. Fan switch
f. Gas leaks
g. Pressure regulator
h. Pilot and thermocouple
i. Limit switch
j. Heat exchanger
k. Thermostat
l. Combustion efficiency
m. Wiring
n. Checking complete cycle
o. Proper use of check sheet

Provide Demonstration On:

Performing a complete pre-season check-up on a gas furnace

Provide Practical Application On:

Performing a pre-season check on an operating furnace using a check sheet

INSTRUCTIONAL MATERIALS

Textbooks:

a. Althouse, *Modern Refrigeration and Air Conditioning*
b. Cooper, *Warm Air Heating for Climate Control*
c. Manufacturer's instruction and maintenance manual

A/Vs:

Georgia, "Performing Pre-Season Check-Up and Start-Up," slide/tape HE-17

Student Manuals:

Georgia, *Heating*, Unit HE-17

Tools and Equipment:

a. Small hand tools
b. Volt-ohmmeter
c. Flashlight
d. Oil can and grease
e. Thermometers
f. Mirror
g. Operational gas furnace

LAB HOURS	2
CLASS HOURS	6

EVALUATION (HE-17)

a. Given an operational gas furnace, the student will perform a pre-season check and start-up.

b. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

TASK

HE-18 Troubleshooting the gas heating system

PERFORMANCE OBJECTIVE

Troubleshoot the gas heating system.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Filters
b. Pilot problems
c. Main gas valve problems
d. Thermostat calibration
e. Gas pressure
f. Heat exchanger
g. Venting systems
h. Proper combustion
i. Burners
j. Fan system

Provide Demonstration On:

Correct troubleshooting techniques

Provide Practical Application On:

Diagnosing and repairing various malfunctions in a gas furnace

INSTRUCTIONAL MATERIALS

Textbooks:

a. Cooper, Warm Air Heating for Climate Control
b. Carrier Heating Manual

Student Manuals:

Georgia, Heating, Unit HE-18

Tools and Equipment:

a. Combustion test kit
b. Small hand tools
c. Flashlight
d. Volt-ohmmeter
e. Water manometer
f. Operational gas furnace

LAB HOURS	4
CLASS HOURS	6

EVALUATION (HE-18)

a. Given a warm air gas furnace with electrical, mechanical and combustion problems, the student will properly locate the problems and make necessary repairs.

b. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

TASK

HE-19 Identifying types of fuel oil and their principles of combustion

PERFORMANCE OBJECTIVE

Identify types of fuel oil and their principles of combustion.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

Different grades of oil
1. Where they are used
2. How they are used
3. BTU content
4. Viscosity
5. Pour point
6. Flash point
7. Fire point

Provide Demonstration On:

Grades of fuel oil

Provide Practical Application On:

Identifying different grades of fuel oil by their characteristics

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Domestic and Commercial Oil Burners
b. Carrier, Oil Burners

Student Manuals:

Georgia, Heating, Unit HE-19

Tools and Equipment:

Various grades of fuel oil

LAB HOURS 4
CLASS HOURS 6

EVALUATION (HE-19)

a. Given samples of different grades of fuel oil, the student will identify and define the use and heat value of each.

b. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

TASK

HE-20 Designing and installing oil piping

PERFORMANCE OBJECTIVE

Design and install oil piping.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Installing an outside oil tank
b. Local and state codes and piping
c. Accessory piping
d. Oil filter types
e. Two-pipe oil burning system
f. Single-pipe oil burning system

Provide Demonstration On:

Properly designed oil burner pipe and tank systems

Provide Practical Application On:

Designing and installing an oil storage tank and piping system for an oil burning furnace

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Domestic and Commercial Oil Burners
b. Georgia State Code

Student Manuals:

Georgia, Heating, Unit HE-20

Tools and Equipment:

a. Small hand tools
b. Tube cutting and flaring set
c. Fittings
d. Oil storage tank

LAB HOURS	6
CLASS HOURS	6

EVALUATION (HE-20)

a. Given an oil burning furnace, the student will design the piping and oil storage tank.

b. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

TASK

HE-21 Installing oil burners

PERFORMANCE OBJECTIVE

Install oil burners.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. The burner assembly
    1. Pump
    2. Blower
    3. Electrode assembly
    4. Nozzle
    5. Transformer
    6. Coupling
    7. Electric motor
b. Installing an oil burner assembly

Provide Demonstration On:

a. Removing and replacing a burner on a domestic oil burner
b. Identifying each component of burner assembly

Provide Practical Application On:

Removing and installing a burner assembly on a domestic oil furnace

INSTRUCTIONAL MATERIALS

Textbooks:

Burghardt, Domestic and Commercial Oil Burners

A/Vs:

Georgia, "Installing Oil Burners," slide/tape HE-21a

Student Manuals:

Georgia, Heating, Unit HE-21

Tools and Equipment:

a. Small hand tools
b. Socket set with extension
c. Burner assembly

LAB HOURS 4
CLASS HOURS 6

EVALUATION (HE-21)

a. Given an oil fired furnace and gun assembly, the student will properly install the assembly and place the unit in operation.

b. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

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TASK

HE-22 Installing and servicing transformers and electrodes

PERFORMANCE OBJECTIVE

Install and service transformers and electrodes.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Setting up transformer
b. Testing the transformer
c. Electrodes
    1. Settings of electrodes
    2. Testing of electrodes
d. High tension leads
e. Insulators

Provide Demonstration On:

Correct installation and servicing techniques for the fuel oil ignition system

Provide Practical Application On:

a. Identifying the components of the ignition system
b. Removing and re-installing the ignition assembly
c. Troubleshooting problems in the ignition system

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Domestic and Commercial Oil Burners
b. Field, Oil Burners

A/Vs:

Georgia, "Installing and Servicing Transformers and Electrodes," slide/tape HE-22a

Student Manuals:

Georgia, Heating, Unit HE-22

Tools and Equipment:

a. Small hand tools
b. Volt-ohmmeter
c. Socket set
d. Operational oil burner

LAB HOURS	4
CLASS HOURS	6

EVALUATION (HE-22)

a. Given an oil burning furnace, the student will remove, replace and troubleshoot problems in the ignition assembly.

b. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

TASK

HE-23 Installing oil pumps

PERFORMANCE OBJECTIVE

Install oil pumps.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. The pump assembly
b. Single stage pumps
c. Two stage pumps
d. Identifying component parts of the pump
e. Venting air from the pump
f. Advantages of using two stage pumps with underground tanks
g. Diagnosing pump malfunctions

Provide Demonstration On:

Correct procedures for removing, servicing or repairing and replacing the pump assembly

Provide Practical Application On:

a. Diagnosing and repairing or replacing an oil burner pump
b. Adjusting oil pressure

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Domestic and Commercial Oil Burners
b. Althouse, Modern Refrigeration and Air Conditioning

A/Vs:

Georgia, "Installing Oil Pumps," slide/tape HE-23

Student Manuals:

Georgia, Heating, Unit HE-23

Tools and Equipment:

a. Small hand tools
b. Pressure gauge
c. Operational oil furnace
d. Oil pump assembly

LAB HOURS	4
CLASS HOURS	6

EVALUATION (HE-23)

a. Given an oil burning furnace, the student will properly remove, repair, replace and test an oil pump assembly.

b. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

TASK

HE-24 Servicing blower, nozzle, motor and coupling

PERFORMANCE OBJECTIVE

Service blower, nozzle, motor and coupling.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Types of motors
b. Reset button
    1. Manual-reset
    2. Automatic-reset
c. Checking the motor
    1. Required voltage (EMF) supply
    2. Hertz (cycle)
    3. Running current (amperes)
    4. Locked current draw
d. Types of couplings and their functions
f. Nozzles and their functions
g. Diagnosing malfunctions in motors, blowers, couplings and nozzles

Provide Demonstration On:

Proper troubleshooting repair and servicing procedures

Provide Practical Application On:

Troubleshooting, repairing and servicing procedures

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Domestic and Commercial Oil Burners
b. Field, Oil Burners
c. Cooper, Warm Air Heating for Climate Control

Student Manuals:

Georgia, Heating, Unit HE-24

Tools and Equipment:

a. Small hand tools
b. Socket set
c. Volt-ohmmeter
d. Flashlight
e. Operational oil burning heating system

LAB HOURS	4
CLASS HOURS	6

EVALUATION (HE-24)

a. Given an oil burning furnace, the student will properly install, troubleshoot and service the combustion blower, nozzle, motor and coupling so that the unit is fully operational.

b. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

TASK

HE-25 Performing the combustion efficiency test

PERFORMANCE OBJECTIVE

Perform the combustion efficiency test.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Type and shape of combustion chamber
b. Different types of heat exchangers
c. Types of vent pipe
d. Restrictions on the use of different types of vent pipe
e. Barometric dampers
f. Performing the combustion efficiency test
g. CO_2 analysis
h. Stack temperature
i. Smoke test
j. Draft test

Provide Demonstration On:

a. Performing the combustion efficiency test
b. Types A, B and C vent systems

Provide Practical Application On:

a. Performing a combustion efficiency analysis
b. Installing vent pipe
c. Diagnosing malfunctions in the combustion chamber and heat exchanger

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Domestic and Commercial Oil Burners
b. Georgia State Code

A/Vs:

Georgia, "Installing Vent and Heat Exchanger," slide/tape HE-25

Student Manuals:

Georgia, Heating, Unit HE-25

Tools and Equipment:

a. CO_2 analyzer kit
b. Small hand tools
c. Flashlight
d. Operational oil burning heating system

LAB HOURS	2
CLASS HOURS	6

EVALUATION (HE-25)

a. Given an operational oil burning furnace, the student will properly determine the type of heat exchanger vent system and perform a combustion efficiency test.

b. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

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TASK

HE-26 Installing controls

PERFORMANCE OBJECTIVE

Install controls.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Control transformers
b. Control pumps and blowers
c. Constant ignition switches
d. Intermittent ignition switches
e. Stack switches
f. Fan and limit controls
g. Cadmium cells
h. Wiring of components
i. Diagnosing malfunctions in the system

Provide Demonstration On:

Proper techniques for troubleshooting, removing and replacing controls

Provide Practical Application On:

Diagnosing, repairing, removing and replacing controls

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Domestic and Commercial Oil Burners
b. Field, Oil Burners

Student Manuals:

Georgia, Heating, Unit HE-26

Tools and Equipment:

a. Small hand tools
b. Flashlight
c. Wiring diagrams
d. Volt-ohmmeter
e. Amprobe
f. Operational oil burning heating system

LAB HOURS 4

CLASS HOURS 6

EVALUATION (HE-26)

a. Given an operational oil burning furnace, the student will properly identify, remove and replace primary control and safety controls and insure proper operation.

b. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

TASK

HE-27 Performing pre-season start-up and check-up on an oil burning heating system

PERFORMANCE OBJECTIVE

Perform pre-season start-up and check-up on an oil burning heating system.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Nozzle check
b. Primary control operation
c. Fan motor
d. Fan and limit switches
e. Oil pump pressure
f. Combustion efficiency
g. Proper ignition
h. Electrode setting
i. Oil filter cleaning
j. Using a checklist

Provide Demonstration On:

Steps in making a pre-season check and start-up

Provide Practical Application On:

Performing tests on all parts of an oil burning furnace and making adjustments for proper operation of the furnace

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Domestic and Commercial Oil Burners
b. Cooper, Warm Air Heating for Climate Control
c. Manufacturer's operating and maintenance manuals

A/Vs:

Georgia, "Performing Pre-Season Start-Up and Check-Ups," slide/tape HE-27

Student Manuals:

Georgia, Heating, Unit HE-27

Tools and Equipment:

a. Small hand tools
b. Pressure gauge
c. Flashlight
d. Volt-ohmmeter
e. Amprobe
f. Combustion efficiency test kit
g. Operational oil burning furnace

LAB HOURS	4
CLASS HOURS	6

EVALUATION (HE-27)

a. Given an operational oil burning furnace, the student will properly perform a pre-season start-up and check and will make any adjustments necessary for the proper operation of the furnace.

b. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

TASK

HE-28 Troubleshooting the oil burning heating system

PERFORMANCE OBJECTIVE

Troubleshoot the oil burning heating system.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Sequence of operation of an oil burning heating system
b. The use of a checklist
c. Diagnosing various malfunctions
d. Testing combustion efficiency
e. Fuel oil problems
f. Transformer and electrode problems
g. Nozzle problems
h. Primary control problems
i. Flame detector problems
j. Fan limit switch problems

Provide Demonstration On:

The use of test instruments in diagnosing problems

Provide Practical Application On:

Diagnosing malfunctions and making necessary repairs for the proper operation of the furnace

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, *Domestic and Commercial Oil Burners*
b. Cooper, *Warm Air Heating for Control Climate*
c. Manufacturer's manuals

A/Vs:

Georgia, "Troubleshooting the Oil Burning Heat System," slide/tape HE-28

Student Manuals:

Georgia, *Heating*, Unit HE-28

Tools and Equipment:

a. Small hand tools
b. Flashlight
c. Volt-ohmmeter
d. Amprobe
e. Pressure gauge
f. Combustion test kit
g. Mirror
h. Operational oil burning furnace

LAB HOURS	4
CLASS HOURS	6

EVALUATION (HE-28)

a. Given an oil burning furnace, the student will diagnose various malfunctions in the system and make any necessary repairs so that the furnace is fully operational.

b. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

TASK

SM-01 Identifying materials used in sheet metalwork

PERFORMANCE OBJECTIVE

Identify materials used in sheet metalwork.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Properties of sheet metals
   1. Strength
   2. Ductility
   3. Malleability
   4. Weldability
   5. Hardness
   6. Toughness
   7. Brittleness
   8. Cold-working
b. Types of sheet metal
   1. Metals
   2. Alloys
   3. Coated metals
   4. Supplies

(Continued on back)

Provide Demonstration On:

a. Identifying types of sheet metal
b. Making property tests on various sheet metals
c. Determining gage, weight and size of metals

Provide Practical Application On:

a. Comparing various sheet metals by making simple property tests and note how metals react to
   1. Hammering
   2. Bending
   3. Weight

(Continued on back)

INSTRUCTIONAL MATERIALS

Textbooks:

a. Johnson, Technical Metals
b. Feirer, Metalwork

A/Vs:

Bergwall, "Sheet Metalwork, Introduction and Overview," filmstrip

Tools and Equipment:

a. Metal samples
   1. Galvanized iron
   2. Tin plate
   3. Galvannealed iron
   4. Zinc
   5. Black iron sheets
   6. Sheet copper
   7. Aluminum
   8. Stainless steel

(Continued on back)

LAB HOURS	2
CLASS HOURS	4

EVALUATION (SM-01)

a. Given various samples of sheet metals, the student will accurately identify each as to type of metal, alloy or coated metal.

b. Given an instructor developed test, the student will accurately relate the special properties required of metals used in the air conditioning, heating and refrigeration industry.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

c. Factors that determine the selection of various metals
    1. Specifications
    2. Availability
    3. Cost
    4. Economical sizes

d. Standard gages, weights and sizes of sheet metal

Provide Practical Application On:

b. Visually identifying metal samples on display board

INSTRUCTIONAL MATERIALS

Tools and Equipment:

b. Hammer
c. Thickness gage calipers
d. Standard gage and weight tables
e. Rules

TASK

SM-02 Developing sheet metal patterns

PERFORMANCE OBJECTIVE

Develop sheet metal patterns.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Types of patterns
   1. Straight-line or angular
   2. Parallel-line or cylindrical
   3. Triangulation or transition
b. Single hems
c. Double hems
d. Lap seams
e. Grooved seams
f. Edges (wired)
g. Master patterns or templates
h. Notching and clipping

Provide Demonstration On:

a. Developing a straight-line layout
b. Developing a parallel-line layout
c. Developing a radial-line layout
d. Developing a traingulation layout
e. Making allowances for edges, seams and hems
f. Notching and clipping sheet metal

Provide Practical Application On:

(Continued on back)

INSTRUCTIONAL MATERIALS

Textbooks:

a. Johnson, Technical Metals
b. Feirer, Metalwork

A/Vs:

Bergwall, "Straight Line Pattern Development," filmstrip; "Parallel and Radial Line Pattern Development," filmstrip

Tools and Equipment:

a. Paper
b. Prick punch
c. Scratch awl
d. Pencil
e. Pratractor
f. Straight edge
g. Sheet metal

LAB HOURS	4
CLASS HOURS	6

EVALUATION (SM-02)

Using appropriate tools and straight, parallel, radial and triangulation developments, the student will accurately layout a pattern of each and accurately transfer each to sheet metal.

INSTRUCTIONAL ACTIVITIES

Provide Practical Application On:

a. Developing stretchouts using straight, parallel, radial and triangulation layout
b. Transferring pattern to sheet metal

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TASK

SM-03 Cutting sheet metal

PERFORMANCE OBJECTIVE

Cut sheet metal.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Hand snips
    1. Straight snips
    2. Double cutting snips
    3. Hawk-billed snips
    4. Aviation snips
    5. Circular cutting snips
    6. Heavy duty snips
b. Cutting straight and curved lines
c. Using the hollow punch
d. Portable power shears
e. Rotary and lever slitting shears
f. Squaring shears
    1. Front gage
    2. Back gage

(Continued on back)

Provide Demonstration On:

a. Cutting sheet metal with hand snips
b. Using the hollow punch
c. Cutting sheet metal using portable power, rotary and lever slitting shears
d. Cutting sheet metal with squaring shears

Provide Practical Application On:

a. Using hand snips to cut to a pattern layout
b. Cutting sheet metal with squaring shears

INSTRUCTIONAL MATERIALS

Textbooks:

a. Johnson, Technical Metals
b. Feirer, Metalwork

A/Vs:

a. Prentice-Hall, "Cutting Sheet Metal," filmstrip
b. Bergwall, "Cutting Methods," filmstrip

Tools and Equipment:

a. Squaring shears
b. Hand snips
c. Metal
d. Pattern
e. Prick punch
f. Scratch awl
g. Hollow punch
h. Ballpeen hammer
i. Cold-chisel
j. Hacksaw
k. Combination square

LAB HOURS	4
CLASS HOURS	6

EVALUATION (SM-03)

a. Provided a pattern and metal, the student will accurately cut sheet metal to the pattern using hand snips.

b. Provided a pattern and metal, the student will accurately transfer the pattern and use squaring shears to cut the metal.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

  3. Front and bevel-gage with pattern

g. Cold chisel

TASK

SM-04 Bending sheet metal by hand

PERFORMANCE OBJECTIVE

Bend sheet metal by hand.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Bending equipment
  1. Bench plate or stakeholder
  2. Beakhorn stake
  3. Bottom stake
  4. Coppersmith stake
  5. Common square stake
  6. Beveled-edge stake
  7. Double-seaming stake
  8. Round-head stake
  9. Hatchet stake
  10. Creasing stake
  11. Needle case stake
  12. Candlemood stake
  13. Blowhorn stake
  14. Conductor stake

(Continued on back)

Provide Demonstration On:

a. Using stakes, seamers, hammers and mattelts
b. Making angular bends
c. Bending cylindrical shapes
d. Forming cone-shaped articles

Provide Practical Application On:

a. Making a sharp-angle bend over hatchet stake
2. Forming a curved piece over a stake or pipe
c. Forming a cone-shaped object such as part of a funnel

INSTRUCTIONAL MATERIALS

Textbooks:

a. Johnson, Technical Metals
b. Feirer, Metalwork

A/Vs:

Bergwall, "Drilling, Forming and Bending-Part 2," filmstrip

Tools and Equipment:

a. Stakes
b. C-clamps
c. Vise
d. Hardwood blocks
e. Steel bars
f. Wooden or rawhide mallet
g. Riveting hammer
h. Setting-down hammer
i. Seamers
j. Metal

LAB HOURS 4

CLASS HOURS 6

EVALUATION (SM-04)

Using previously cut metal and appropriate bending tools, the student will, by hand, make a box to 1/32" accuracy, form a cylinder and a cone to job specifications.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

15. Hollow mandrel stake
16. Double-seaming stake with four heads
17. Handy seamer
18. Riveting hammer
19. Setting-down hammer
20. Wooden or rawhide mallet

b. Angular bends
c. Bending cylindrical shapes
d. Forming cone-shaped articles

TASK

SM-05 Bending metal on a bar folder or brake

PERFORMANCE OBJECTIVE

Bend metal on a bar folder or brake.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Operation of the bar folder
b. Making a fold or hem
c. Making a rounded fold for a wired edge
d. Brakes
    1. Cornice brake
    2. Box and pan brake

Provide Demonstration On:

a. Operating the bar folder
b. Forming folds and hems on the bar folder
c. Operating brakes

Provide Practical Application On:

a. Using the bar folder to form a sharp fold, a rounded fold, right-angle folds, a hem and a double hem
b. Using a box and pan brake to form a box

INSTRUCTIONAL MATERIALS

Textbooks:

a. Johnson, Technical Metals
b. Feirer, Metalwork

A/Vs:

Bergwall, "Drilling, Forming and Bending-Part 1," filmstrip

Tools and Equipment:

a. Bar folder
b. Brake
c. Setting hammer
d. Metal
e. Mallet

LAB HOURS	4
CLASS HOURS	6

EVALUATION (SM-05)

a. Using sheets of metal and a bar folder, the student will accurately form a sharp fold, a rounded fold, right-angle folds, a hem and a double hem.

b. Using a box and pan brake, the student will accurately make a layout on the metal and form a box.

TASK

SM-06 Roll-forming sheet metal

PERFORMANCE OBJECTIVE

Roll-form sheet metal.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Operation of forming rolls or slip-roll
b. Forming a cylinder
c. Rolling a cylinder with a fold on both edges
d. Rolling a cylinder with a wired edge
e. Forming cone shapes

Provide Demonstration On:

a. Operating the roll-forming machine
b. Forming a cylinder or a cylinder with a fold on both edges
c. Rolling a cylinder with a wired edge
d. Forming cone shapes

Provide Practical Application On:

a. Forming a cylinder and a cylinder with a fold on both edges
b. Rolling a cylinder with a wired edge
c. Roll-forming a cone shape

INSTRUCTIONAL MATERIALS

Textbooks:

a. Johnson, Technical Metals
b. Feirer, Metalwork

Tools and Equipment:

a. Metal
b. Roll-forming machine

LAB HOURS	4
CLASS HOURS	6

EVALUATION (SM-06)

Using a roll-forming (or slip rolling) machine and sheets of metal, the student will accurately form a cylinder, a cylinder with a fold on both edges, a cylinder with wired edges and a cone.

TASK

SM-07 Making seams

PERFORMANCE OBJECTIVE

Form sheet metal seams.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Seams
   1. Single
   2. Butt
   3. Lap
      - Plain lap
      - Counter sunk or offset lap
      - Inside or outside corner lap
   4. Grooved and folded
   5. Standing
   6. Double
   7. Pittsburgh lock

b. Hand groovers

Provide Demonstration On:

a. Double-seaming a bottom on a cylinder
b. Double-seaming a square or rectangular article
c. Making a folded or grooved seam

Provide Practical Application On:

a. Forming single, butt, lap, standing and double seams
b. Forming a folded or grooved seam

INSTRUCTIONAL MATERIALS

Textbooks:

a. Johnson, Technical Metals
b. Feirer, Metalwork

A/Vs:

a. Prentice-Hall, "Seams and Joints," filmstrip
b. Bergwall, "Assembly and Fastening," filmstrip

Tools and Equipment:

a. Bar folder or brake
b. Burring machine
c. Hand groover
d. Setting hammer
e. Mallet
f. Stakes
g. Metal

LAB HOURS	4
CLASS HOURS	6

EVALUATION (SM-07)

a. Given a burring or flanging machine, setting hammer and a cylinder, the student will accurately form single seams to fasten a bottom to the cylinder.

b. Given a bar folder, mallet, setting hammer and metal, the student will accurately form a double seam on a square container.

c. Given a bar folder, metal, a hand groover and mallet, the student will accurately form a folded or grooved seam.

TASK

SM-08 Using the rotary machine

PERFORMANCE OBJECTIVE

Use the rotary machine.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. The combination rotary machine
b. Making a wired edge
c. Turning an edge
d. Closing the wired edge by hand
e. Closing the wired edge by machine
f. Turning a burr or flange
g. Beading
    1. The single bead
    2. The ogee bead
    3. The triple bead
h. Crimping
i. Slitting and trimming

Provide Demonstration On:

a. Using the rotary machine
b. Wiring an edge
c. Turning a burr
d. Beading
e. Crimping

Provide Practical Application On:

a. Wiring an edge
b. Beading, crimping, slitting and trimming metal

INSTRUCTIONAL MATERIALS

Textbooks:

a. Johnson, Technical Metals
b. Feirer, Metalwork

Tools and Equipment:

a. Combination rotary machine
b. Mild steel wire
c. Stakes
d. Pliers
e. Mallet
f. Setting hammer
g. Metal

LAB HOURS	4
CLASS HOURS	6

EVALUATION (SM-08)

a. Using the combination rotary machine, hand tools and wire, the student will select the appropriate tools and accurately wire the edge of a cylinder.

b. Given a cylindrical container, the student will select the appropriate rolls to be placed on the combination rotary machine and accurately form a single bead, an ogee bead and a triple bead.

c. Given a cylindrical object (such as a heating pipe), the student will select the appropriate rolls to be placed on the combination rotary machine and accurately crimp the edge of one end of the pipe.

TASK

SM-09 Fastening sheet metal

PERFORMANCE OBJECTIVE

Fasten sheet metal.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Riveting tools and rivets
    1. Riveting hammer
    2. Solid punch
    3. Rivet set
    4. Tinner's rivets
        -Black - iron
        -Galvanized
        -Copper
    5. Blind or pop rivets
    6. Hand lever
b. Riveting sheet metal
    1. Determining rivet length
    2. Determining rivet diameter
    3. Spacing rivets
    4. Removing a rivet

(Continued on back)

Provide Demonstration On:

a. Using riveting tools and rivets
b. Riveting sheet metal
c. Fastening sheet metal with tapping screws

Provide Practical Application On:

a. Riveting sheet metal
b. Fastening sheet metal with tapping screws

INSTRUCTIONAL MATERIALS

Textbooks:

a. Johnson, Technical Metals
b. Feirer, Metalwork

A/Vs:

a. Bergwall, "Assembly and Fastening," filmstrip
b. Prentice-Hall, "Riveting and Fastening," filmstrip; "Making Holes in Sheet Metal," filmstrip

Tools and Equipment:

a. Rivet set
b. Solid punch
c. Riveting hammer
d. Hand lever
e. End-grain wood or lead block
f. Metal
g. Prick punch
h. Drills
i. Screws
j. Screwdriver

LAB HOURS	4
CLASS HOURS	6

EVALUATION (SM-09)

a. Given riveting tools, rivets and a seam to be fastened, the student will accurately select the appropriate tools and set the necessary rivets.

b. Given two pieces of metal to secure together, the student will accurately select the appropriate tools and fasten the metal with threaded fasteners.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

c. Fastening with tapping screws
    1. Thread cutting screws
    2. Thread forming screws
d. Installing sheet metal screws

TASK

VM-01 Reading and interpreting the shop service manuals

PERFORMANCE OBJECTIVE

Read and interpret the shop service manuals.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Necessary data required
b. Identifying the correct manual
c. Specification charts
d. Flat rate manuals
e. Updating the manual

Provide Demonstration On:

a. Locating data
b. Reading specification charts
c. Reading flat rate manuals
d. Posting the manual

Provide Practical Application On:

a. Identifying data
b. Using specification charts
c. Using flat rate manual
d. Posting the manual

INSTRUCTIONAL MATERIALS

Tools and Equipment:

a. Data plate
b. Service manual
c. Flat rate manual

LAB HOURS	0
CLASS HOURS	4

EVALUATION (VM-01)

Given a task and a model number, the student will locate the task in the correct service manual and list the specifications required with 100% accuracy.

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TASK

VM-02 Identifying and maintaining shop tools and equipment

PERFORMANCE OBJECTIVE

Identify and maintain shop tools and equipment.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Tool design
b. Tool use and selection
c. Storing equipment
d. Maintaining fire protection equipment
e. Repairing tools
f. Using cleaning equipment

Provide Demonstration On:

a. Selecting and using tools safetly
b. Repairing tools
c. Fire codes
d. Using cleaning equipment

Provide Practical Application On:

a. Selecting and using tools
b. Using cleaning equipment
c. Repairing tools

INSTRUCTIONAL MATERIALS

Textbooks:

Crouse and Anglin, Automotive Tools, Fasteners and Measurements

A/Vs:

a. Bergwall, "Automotive Hand Tools Explained," filmstrip/cassette
b. Prentice-Hall, "Auto Mechanics Tools and Basic Skills," filmstrip/cassette

Student Manuals:

MAVCC, Auto Mechanics or Small Engines Program

Tools and Equipment:

a. Discarded parts
b. Hand tools
c. Steam cleaner
d. Parts bath

LAB HOURS 4

CLASS HOURS 6

EVALUATION (VM-02)

a. Given a specific task, the student will select a tool and demonstrate safe and proper use according to job specifications.

b. V'TECS, Small Engine Repair, Task Nos. 27, 29.

TASK

VM-03 Using precision measurement tools and equipment

PERFORMANCE OBJECTIVE

Use precision measurement tools and equipment.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Measuring units
b. Plastigage
c. Micrometers
d. Calipers
e. Depth gauges
f. Timing tools

Provide Demonstration On:

a. Reading micrometers and calipers
b. Using plastigage
c. Using and reading depth guages
d. Using and reading timing tools

Provide Practical Application On:

a. Measuring tolerances requiring use of several different tools
b. Setting up timing tools

INSTRUCTIONAL MATERIALS

Textbooks:

Stovett, How to Read, Use and Care for Micrometers and Vernier Gages

A/Vs:

a. Georgia, Metals Fabrication Cluster, "Parts of the Micrometer," slide/tape
b. Prentice-Hall, "Machine Shop Bench Operating," filmstrip

Tools and Equipment:

a. Micrometers of various sizes
b. Vernier calipers
c. Plastigage
d. Discarded parts to measure
e. Timing tools
f. Engine for timing set-up

LAB HOURS 2

CLASS HOURS 4

EVALUATION (VM-03)

Given an out of round crankshaft and necessary tools, equipment and specifications, the student will determine useability of part according to the specifications.

TASK

VM-04 Demonstrating an understanding of engine theories of operation

PERFORMANCE OBJECTIVE

Demonstrate an understanding of engine theories of operation.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Power terms
b. Parts and components
c. Principles of operation
d. Differences between gas and diesel engines

Provide Demonstration On:

a. Relationship of parts
b. Engine operation
c. Comparing diesel and gas engines

Provide Practical Application On:

a. Identifying parts
b. Comparing diesel and gas engines

INSTRUCTIONAL MATERIALS

Textbooks:

a. AAVIM, Care and Operation of Small Engines, Vol. 1
b. AAVIM, Maintenance and Repair of Small Engines, Vol. 2
c. Briggs and Stratton, Repair Instructions IV
d. Glenn, Auto Mechanics
e. Mitchell Manuals, Repair Manual
f. Pipe, Small Gasoline Engines Training Manual
g. Stephenson, Power Technology

(Continued on back)

Tools and Equipment:

a. Engine cut-a-way (gas)
b. Engine cut-a-way (diesel)
c. Disassembled engine
d. Shop manuals

LAB HOURS	2
CLASS HOURS	4

EVALUATION (VM-04)

Given necessary tools, equipment and engine parts, the student will identify parts and components and list the operational sequences with 80% accuracy.

INSTRUCTIONAL MATERIALS

Textbooks:

Stockel, Automechanics Fundamentals

A/Vs:

a. Bergwall, "The Internal Combustion Engine Explained," filmstrip #1; "The Four-Cycle Diesel Engine Explained," filmstrip
b. Prentice-Hall, "The Basic Engine," filmstrip

TASK

VM-05 Demonstrating a knowledge of electricity fundamentals

PERFORMANCE OBJECTIVE

Demonstrate a knowledge of electricity fundamentals.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Electron theory
b. Conductors and insulators
c. Generating and storing electricity
d. Ohm's law and power formula
e. Test meters
f. Circuits and schematics
g. Symbols
h. Solenoids, switches and motors

Provide Demonstration On:

a. Electron theory
b. Generating electricity
c. Wiring circuits
d. Using test motors
e. Testing electrical devices

Provide Practical Application On:

a. Wiring and testing circuits
b. Computing Ohm's law and power formula

INSTRUCTIONAL MATERIALS

Textbooks:

AAVIM, Understanding Electricity and Electrical Terms

A/Vs:

a. AAVIM, "Understanding Electricity and Electrical Terms," slide set and transparency
b. Prentice-Hall, "Basic Automotive Service," Filmstrip; "Auto Mechanics Tool and Basic Skills," filmstrip

(Continued on back)

Tools and Equipment:

a. Wiring board
b. Test meters
c. Small electric devices

LAB HOURS	2
CLASS HOURS	4

EVALUATION (VM-05)

a. Given a volt-ohmmeter, a schematic drawing and necessary tools and equipment, the student will make the necessary wiring connections and record volts, ohms and amperage readings at five different points. All readings must be within 10% of known values.

b. Georgia, Electro-Mechanical, Teacher's Guide, Vol. IV.

INSTRUCTIONAL MATERIALS

A/Vs:

c. Briggs and Stratton, "Custom VOA Meter," slide set; "Glossary of Electrical Terms," slide set; "Electricity and Basic Electrical Terms," slide set

TASK

VM-06 Demonstrating an understanding of fuels

PERFORMANCE OBJECTIVE

Demonstrate an understanding of fuels.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Safety
b. Properties of fuels
c. Selecting fuels
d. Storing and handling fuels

Provide Demonstration On:

Storing and handling fuels

Provide Practical Application On:

Selecting and refueling an engine

INSTRUCTIONAL MATERIALS

Textbooks:

a. AAVIM, *Selecting and Storing Fuels and Lubricants*
b. Crouse, *Automotive Mechanics*
c. Stockel, *Auto Mechanics Fundamentals*

A/Vs:

AAVIM, "Selecting and Storing Fuels and Lubricants," slide set and transparency

Tools and Equipment:

a. Fuels
b. Fuel containers

LAB HOURS 1

CLASS HOURS 1

EVALUATION (VM-06)

Given a selction of fuels and an engine, the student will refuel the engine with the correct fuel with 100% accuracy.

TASK

VM-07 Demonstrating an understanding of lubricants

PERFORMANCE OBJECTIVE

Demonstrate an understanding of lubricants.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Properties of lubricants
b. Selecting lubricants
c. Storing and handling lubricants
d. Cleaning lubricants (filters)

Provide Demonstration On:

a. Selecting lubricants
b. Wear due to lack of or dirty lubricants

Provide Practical Application On:

Changing oil

INSTRUCTIONAL MATERIALS

Textbooks:

a. AAVIM, Small Engines, Vol. I, II
b. Crouse, Automotive Mechanics
c. Stockel, Auto Mechanics Fundamentals

Tools and Equipment:

a. Various types of oil
b. Various types of grease
c. Oil filters

LAB HOURS 1
CLASS HOURS 1

EVALUATION (VM-07)

Given an automobile or small engine powered equipment, the student will determine the proper lubricant for the engine and chassis. Selection of lubricants must meet manufacturer's specifications.

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TASK

VM-08 Demonstrating an understanding of hardware and fasteners

PERFORMANCE OBJECTIVE

Demonstrate an understanding of hardware and fasteners.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Identifying fasteners
b. Fastener grades
c. Sizing fasteners
d. Torque valves

Provide Demonstration On:

a. Selecting and installing fasteners
b. Tightening fasteners

Provide Practical Application On:

Selecting and installing fasteners and hardware

INSTRUCTIONAL MATERIALS

A/Vs:

Prentice-Hall, "Auto Mechanics Tools and Basic Skills," filmstrip

Tools and Equipment:

a. Selection of fasteners
b. Torque wrenches
c. Sizing tools

(Other materials are available from local nut and bolt supply stores.)

LAB HOURS	1
CLASS HOURS	1

EVALUATION (VM-08)

Given a selection of fasteners, the student will select and install the fastener and tighten according to manufacturer's specifications.

TASK

VM-09 Demonstrating basic metals operations

PERFORMANCE OBJECTIVE

Demonstrate basic metals operations.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Cutting metals
b. Filing and grinding
c. Drilling holes
d. Making threads
e. Removing broken bolts and screws
f. Loosening seized parts
g. Installing threaded inserts

Provide Demonstration On:

a. Using hack saws and files
b. Selecting and using drills
c. Threading stock
d. Removing broken studs
e. Loosening seized parts
f. Installing threaded inserts

Provide Practical Application On:

a. Constructing a threaded steel block
b. Making threaded studs

INSTRUCTIONAL MATERIALS

A/Vs:

a. Georgia, Transportation Cluster, "Constructing a Thread Gauge Block," slide/tape HT-3; "Removing Broken Stud and Installing Helicoil," slide/tape HT-4
b. Prentice-Hall, "Machine Shop: Bench Operations," filmstrip

Student Manuals:

Georgia, Transportation Cluster, Unit HT 3-5

Tools and Equipment:

a. Metal cutting tools
b. Tap and die set
c. Drills and drill bits
d. Heat lamp or torch
e. Threaded insert kit

LAB HOURS	2
CLASS HOURS	4

EVALUATION (VM-09)

Given necessary tools and equipment, the student will construct a thread guage block and studs. All threaded holes must be at right angles to the guage block and the studs must turn freely.

TASK

VM-10 Demonstrating welding and soldering techniques

PERFORMANCE OBJECTIVE

Demonstrate welding and soldering techniques.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Safety
b. Metal composition
c. Effects of heat
d. Flux and filler rods

Provide Demonstration On:

a. Electric welding
b. Gas welding/brazing
c. Cutting metal with a torch
d. Soldering

Provide Practical Application On:

a. Cutting welding metals using both gas and electric welding equipment
b. Solder wiring using a soldering gun

INSTRUCTIONAL MATERIALS

Textbooks:

Althouse, Turnquist and Bowditch, Modern Welding

A/Vs:

Georgia, Metal Fabrication Cluster, "Setting Up Gas Cutting Equipment," slide/tape GC-1; "Straight Cutting with the Gas Torch," slide/tape GC-2; "Circular Cutting with the Gas Torch," slide/tape GC-3; "Piercing

(Continued on back)

Student Manuals:

Georgia, Metals Fabrication Cluster, Units BW-5, GC 1-5 and GW 1-9

Tools and Equipment:

a. Oxyacetylene outfit
b. Electric welding outfit
c. Soldering gun
d. Welding and soldering materials

LAB HOURS	2
CLASS HOURS	4

EVALUATION (VM-10)

a. Given a gas welder and an electric welder, the student will cut metal and perform a butt weld using each technique. The weld must conform to accepted practices. Given a soldering gun and equipment the student will join two copper wires together in accordance with accepted practices.

b. Georgia, Metal Fabrication Cluster, Pre/Post Checks.

INSTRUCTIONAL MATERIALS

A/Vs:

and Hole Cutting with the Gas Torch," slide/tape GC-4; "Making Bevel Cuts with the Gas Cutting Torch,", slide/tape GC-5; "Setting Up Gas Welding Equipment," slide/tape GW-1; "Neutral Flames," slide/tape GW-1B; "Flange Welding," slide/tape GW-2A; "Running Fusion Beads," slide/tape GW-2; "Making Weld Beads Using Filler Rod," slide/tape GW-6' "Making a Square Edge Buttweld," slide/tape GW-6; "Making a Lap Joint," slide/tape GW-7; "Making an Outside Corner Joint with a Rod," slide/tape GW-9

TASK

VM-11 Checking and changing engine oil and oil filter

PERFORMANCE OBJECTIVE

Check and change engine oil and oil filter.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Engine oils
b. Oil filters
c. Safety
d. Tools and equipment
e. Procedures

Provide Demonstration On:

a. Twin post lift operation
b. Removal and installation of oil filter
c. Correct removal and torquing of drain plug

Provide Practical Application On:

a. Reading dipstick
b. Draining engine oil
c. Removing and replacing filter
d. Refilling crankcase
e. Checking for leaks

INSTRUCTIONAL MATERIALS

Textbooks:

a. Glenn, Auto Mechanics
b. Remling, Basics
c. Toboldt and Johnson, Automotive Encyclopedia

A/Vs:

a. Georgia, Transportation Cluster, "Chassis Lubrication," slide/tape CL-1; "Change Oil and Oil Filter," slide/tape CL-2
b. Georgia, Auto Mechanics, "Servicing the Engine Lubrication System," 212-2

(Continued on back)

Student Manuals:

a. Georgia, Transportation Cluster, Units CL-1, CL-2
b. Gerogia, Auto Mechanics Program, Unit 212-2
c. Oklahoma, Auto Mechanics I

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LAB HOURS	1
CLASS HOURS	1

EVALUATION (VM-11)

a. Given an operational vehicle, tools and equipment, the student will change oil and oil filter according to specifications given by manufacturer. There must be no evidence of oil leaks after engine is warmed up.

b. Oklahoma, Auto Mechanics I.

c. Bergwall, filmstrip questions.

d. Textbooks include test questions.

INSTRUCTIONAL ACTIVITIES

A/Vs:

c. Bergwall, "Lubrication Services," filmstrip
d. Prentice-Hall, "Basic Automotive Service," filmstrip

TASK

VM-12 Checking fluid level and refilling transmission and rear end

PERFORMANCE OBJECTIVE

Check fluid level and refill transmission and rear end.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Types and application of transmission fluids
b. Viscosities of rear end lubricant
c. Effects of temperature to fluids

Provide Demonstration On:

a. Twin post lift operation
b. Using lube dispenser

Provide Practical Application On:

a. Using transmission level gage
b. Pumping lube with lube dispenser

INSTRUCTIONAL MATERIALS

Textbooks:

a. Crouse and Anglin, The Auto Book
b. Crouse and Anglin, Motor Vehicle Inspection
c. Remling, Basics

A/Vs:

a. Georgia, Transportation Cluster, "Changing Automatic Transmission Fluid," slide/tape CL-5
b. Bergwall, "Lubrication Services," filmstrip
c. Prentice-Hall, "Basic Automotive Service," filmstrip

Student Manuals:

a. Georgia Transportation Cluster, Unit CL-5
b. Oklahoma, Auto Mechanics II

Tools and Equipment:

a. Hand tools
b. Gear lube dispenser
c. Transmission filler

LAB HOURS 2

CLASS HOURS 2

EVALUATION (VM-12)

a. Given an operational vehicle, tools and equipment, the student will check fluid level of transmission and rear end and refill if needed. Upon completion there must be no evidence of leaks.

b. Oklahoma, Auto Mechanics II.

c. Bergwall, filmstrip questions.

d. Textbooks include test questions.

TASK

VM-13 Lubricating chassis and components

PERFORMANCE OBJECTIVE

Lubricate the chassis and components of an automobile.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Chassis grease
b. Lubricating equipment

Provide Demonstration On:

a. Correct procedure on cleaning grease fittings before applying grease
b. How to determine correct amount of grease to apply

Provide Practical Application On:

a. Location of grease fittings on components
b. Plumbing correct amounts of grease into components

INSTRUCTIONAL MATERIALS

Textbooks:

a. Crouse and Anglin, The Auto Book
b. Crouse and Anglin, Motor Vehicle Inspection
c. Remling, Basics
d. Stockel, Auto Mechanics Fundamentals

A/Vs:

a. Georgia, Auto Mechanics, "Lubricate the Chassis," slide/tape 212-3

(Continued on back)

Student Manuals:

a. Georgia, Transportation Cluster, Unit CL-4
b. Georgia, Auto Mechanics, Unit 212-3

Tools and Equipment:

a. Grease gun
b. Rags
c. Vehicle

LAB HOURS	1
CLASS HOURS	1

EVALUATION (VM-13)

a. Given an automobile, the student will identify chassis components and determine the need of grease. The learner will apply grease, according to manufacturer's specifications, without damaging components or grease pockets.

b. Bergwall, filmstrip questions.

c. Textbooks include test questions.

d. V'TECS, Automotive Mechanics, Task Nos. 36, 143, 147, 194, 195.

INSTRUCTIONAL MATERIALS

A/Vs:

b. Bergwall, "Lubrication Services," filmstrip
c. Prentice-Hall, "Basic Automotive Service," filmstrip

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TASK

VM-14 Checking and replacing windshield wiper blades

PERFORMANCE OBJECTIVE

Check and replace windshield wiper blades.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Blade types
b. Blade safety regulation
c. Windshield wiper blade mechanisms

Provide Demonstration On:

a. Blade inspection
b. Blade removal

Provide Practical Application On:

a. Inspecting blade for abrasions or tears
b. Removing and replacing blade

INSTRUCTIONAL MATERIALS

Textbooks:

Crouse and Anglin, The Auto Book

Tools and Equipment:

a. Windshield wiper arm removing tool
b. Shop manual
c. Wiper blades

LAB HOURS	1
CLASS HOURS	1

EVALUATION (VM-14)

a. Given an automobile, the student will inspect the windshield wiper blades and replace according to procedures found in the shop manual.

b. V'TECS, Automotive Mechanics, Task No. 1.

TASK

VM-15 Repairing tires and tubes

PERFORMANCE OBJECTIVE

Repair tires and tubes.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Tire construction
b. Tire safety
c. Safety
d. Types and sizes of plugs and patches

Provide Demonstration On:

a. Patching tube type tire
b. Patching tubeless type tire
c. Hot and cold patches
d. Using tire changing equipment

Provide Practical Application On:

a. Locating air leak
b. Patching tube with hot patch
c. Patching tube with cold patch
d. Plugging hole in tubeless tire with vulcanizing plug applicator
e. Dismounting and remounting tire on rim

INSTRUCTIONAL MATERIALS

Textbooks:

a. Crouse and Anglin, The Auto Book
b. Crouse and Anglin, Motor Vehicle Inspection
c. Toboldt and Johnson, Automotive Encyclopedia

A/Vs:

a. Georgia, Transportation Cluster, "Dismount and Mount a Tire," slide/tape SSS-3
b. Prentice-Hall, Basic Automotive Service," filmstrip

Student Manuals:

a. Georgia, Transportation Cluster, Unit SSS-3
b. Oklahoma, Auto Mechanics I

Tools and Equipment:

a. Leak test tank
b. Tire changer
c. Marking crayon
d. Buffing tool
e. Plug applicator
f. Stitching tool

LAB HOURS 1

CLASS HOURS 1

EVALUATION (VM-15)

a. Given a tire with an air leak, the student will plug or patch the tubless tire and patch a hole in a tube. Each exercise will be tested in a test tank to determine success. Patched or plugged areas must not leak and tire must hold specified pounds per square inch recommended by manufacturer.

b. Oklahoma, Auto Mechanics I.

c. Crouse, The Auto Book and Auto Study Guide.

d. Textbooks include test questions.

TASK

VM-16 Replacing light bulbs and fuses

PERFORMANCE OBJECTIVE

Replace light bulbs and fuses.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Sizes and types of light bulbs
b. Sizes and resistances of fuses
c. Procedure to determine malfunction of fuse
d. Electrical wiring diagrams

Provide Demonstration On:

a. Blown or malfunctioning fuse
b. Blown or malfunctioning light bulb
c. Checking bulb and fuse circuits

Provide Practical Application On:

a. Locating fuse box
b. Locating light bulbs
c. Removing fuses from holders
d. Removing light bulbs from sockets

INSTRUCTIONAL MATERIALS

Textbooks:

a. Crouse and Anglin, The Auto Book
b. Crouse and Anglin, Motor Vehicle Inspection
c. Remling, Basics
d. Stockel, Auto Mechanics Fundamentals

A/Vs:

Prentice-Hall, "Basic Automotive Service," filmstrip

Student Manuals:

a. Oklahoma, Auto Mechanics II
b. Ellinger, Automotive Electrical Systems

Tools and Equipment:

a. Hand tools
b. VOM
c. Test light
d. Auto shop manual

LAB HOURS	2
CLASS HOURS	1

EVALUATION (VM-16)

a. Given an operational automobile, the student will test and replace defective bulbs and fuses according to specifications.

b. Oklahoma, Auto Mechanics II.

c. Textbooks include test questions.

d. V'TECS, Automotive Mechanics, Task Nos. 89, 97.

TASK

VM-17 Washing and waxing vehicle

PERFORMANCE OBJECTIVE

Wash and wax a vehicle.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Detergents
b. Addatives
c. Waxes

Provide Demonstration On:

a. Mixing solution for washing
b. Washing a vehicle
c. Wax application

Provide Practical Application On:

Washing and waxing a vehicle

INSTRUCTIONAL MATERIALS

Student Manuals:

Vehicle owner's manual

Tools and Equipment:

a. Detergent
b. Pail
c. Wipe cloth
d. Brushes
e. Chamois

LAB HOURS 2

CLASS HOURS 4

EVALUATION (VM-17)

Given an automobile, the student will wash and wax it, restoring its finish to manufacturer's recommendations.

TASK

VM-18 Adjusting fuel/air mixtures and mechanical linkage

PERFORMANCE OBJECTIVE

Adjust fuel/air mixtures and mechanical linkage.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Fuels
b. Carburetion principles
c. Instrumentation

Provide Demonstration On:

a. Adjusting carburetor
b. Types of linkage

Provide Practical Application On:

a. Adjusting carburetor manual type transmission
b. Adjusting carburetor on automatic type transmission
c. Adjusting carburetor with cruise control unit

INSTRUCTIONAL MATERIALS

Textbooks:

a. Crouse and Anglin, *Automotive Fuel Lubricating and Cooling Systems*
b. Stockel, *Auto Mechanics Fundamentals*

A/Vs:

a. Georgia, "Transportation Cluster, "Inspect, Assemble, Adjust a Single Barrell Rochester Carburetor," slide/tape

(Continued on back)

Student Manuals:

a. Oklahoma, *Auto Mechanics I*
b. Georgia, *Transportation Cluster*, Unit FS-4
c. Ford, *Student Text*

Tools and Equipment:

a. Hand tools
b. Dwell tach
c. Manufacturer's repair manual or auto shop repair manual

LAB HOURS 2

CLASS HOURS 1

EVALUATION (VM-18)

a. Given an operational automotive engine and necessary tools and equipment, the student will adjust fuel/air mixtures to standards of auto shop repair manual. The student will adjust mechanical linkage to allow full opening and closing of the throttle with no binding. The student will adjust mechanical linkage to allow correct working of automotive transmission throttle linkage.

b. Crouse and Anglin, Auto Study Guides.

c. Bergwall, filmstrip questions.

d. Hughes, Guide to the Automobile Mechanic Certification Exam.

e. V'TECS, Automotive Mechanics, Task Nos. 108, 114, 115.

f. Georgia Student Assessment System, Domain Referenced Tests, Transportation/Automotive Mechanics, Volume I, II.

g. Oklahoma, Auto Mechanics I.

INSTRUCTIONAL MATERIALS

A/Vs:

b. Bergwall, "The Operation of the Fuel System," filmstrip
c. Ford, "Fuel and Carburetion," filmstrip

TASK

VM-19 Cleaning or replacing fuel and air filters

PERFORMANCE OBJECTIVE

Clean or replace fuel and air filters.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Fuels
b. Carburetion
c. Filters

Provide Demonstration On:

a. Replacing fuel and air filters
b. Cleaning fuel and air filters

Provide Practical Application On:

a. Cleaning fuel and air filter
b. Replacing air filter
c. Replacing in-line fuel filter
d. Replacing carburetor fuel filter

INSTRUCTIONAL MATERIALS

Textbooks:

a. Crouse and Anglin, Automotive Fuel, Lubricating and Cooling Systems
b. Stockel, Auto Mechanics Fundamentals

A/Vs:

a. Bergwall, "The Operation of the Fuel System," filmstrip
b. Georgia, Auto Mechanics, "Service Air Cleaner," slide/tape 213-10

Student Manuals:

a. Oklahoma, Auto Mechanics I
b. Georgia, Auto Mechanics, Unit 213-10

Tools and Equipment:

a. Hand tools
b. Air filter tester of drop-light

LAB HOURS 2
CLASS HOURS 1

EVALUATION (VM-19)

a. Given an operational automotive engine and necessary tools and equipment, the student will clean and/or replace the fuel and air filters according to manufacturer's specifications.

b. Crouse and Anglin, Auto Study Guide.

c. Bergwall, filmstrip questions.

d. Hughes, Guide to the Automotibile Mechanic Certification Exam.

e. V'TECS, Automotive Mechanics, Task Nos. 112, 113, 116.

f. Georgia Student Assessment System, Domain Referenced Tests, Transportation/Automotive Mechanics, Volume I, II.

g. Oklahoma, Auto Mechanics I.

TASK

VM-20 Removing carburetor from engine

PERFORMANCE OBJECTIVE

Remove carburetor from engine.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

Carburetion

Provide Demonstration On:

Removing carburetor

Provide Practical Application On:

a. Removing 2BBL carburetor
b. Removing 4BBL carburetor

INSTRUCTIONAL MATERIALS

Textbooks:

a. Crouse and Anglin, Automotive Fuel, Lubricating and Cooling Systems
b. Stockel, Auto Mechanics Fundamentals

A/Vs:

Ford, "Carburetor Two and Four Venturi," transparencies

Student Manuals:

Oklahoma, Auto Mechanics I

Tools and Equipment:

Hand tools

LAB HOURS	2
CLASS HOURS	4

EVALUATION (VM-20)

a. Given an operational automotive engine and necessary tools and equipment, the student will remove a 2BBL and a 4BBL carburetor from the engine. The learner will mark all vacuum hoses for later identification purposes.

b. Crouse and Anglin, Auto Study Guide.

c. Hughes, Guide to Automobile Mechanics Certification Exam.

d. Oklahoma, Auto Mechanics I.

TASK

VM-21 Disassembling, cleaning and inspecting carburetor

PERFORMANCE OBJECTIVE

Disassemble, clean and inspect carburetor.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Carburetion
b. Carburetor circuits
c. Carburetor cleaning fluid

Provide Demonstration On:

a. Carburetor disassembly
b. Carburetor cleaning
c. Carburetor inspection

Provide Practical Application On:

a. Disassembling 2BBL and 4BBL carburetor
b. Cleaning 2BBL and 4BBL carburetor
c. Inspecting 2BBL and 4BBL carburetor

INSTRUCTIONAL MATERIALS

Textbooks:

a. Crouse and Anglin, Automotive Fuel, Lubricating and Cooling Systems
b. Stockel, Auto Mechanics Fundamentals

A/Vs:

a. Georgia, Transportation Cluster, "Overhauling a Single Barrell Carburetor," slide/tape FS-3B; "Over-

(Continued on back)

Student Manuals:

a. Georgia, Transportation Cluster, Units FS-3, FS-5
b. Georgia, Auto Mechanics, Units 213-3 - 213-7

Tools and Equipment:

a. Hand tools
b. Carburetor repair tools
c. Auto shop repair manual

LAB HOURS 4

CLASS HOURS 6

EVALUATION (VM-21)

a. Given a 2BBL or 4BBL carburetor and necessary tools and equipment, the student will disassemble, clean and inspect the carburetor parts according to standards of auto shop repair manual.

b. Crouse and Anglin, The Auto Book.

c. Crouse and Anglin, Auto Study Guide.

d. Bergwall, filmstrip questions.

e. Hughes, Guide to the Automobile Mechanic Certification Exam.

f. V'TECS, Automotive Mechanics, Task No. 111.

g. Georgia Student Assessment System, Domain Referenced Tests, Transportation/Automotive Mechanics, Volume I, II.

h. Oklahoma, Auto Mechanics I.

INSTRUCTIONAL MATERIALS

A/Vs:

hauling a Single Barrell Carburetor," slide/tape FS-3A; "Overhauling a Two Barrell Rochester Carburetor," slide/tape FS-5A; "Overhauling a Two Barrell Carburetor," slide/tape FS-3B
b. Georgia, Auto Mechanics, "Overhauling a Single Barrell Rochester Carburetor," slide/tape 213-3A; "Overhauling a Single Barrell Ford Type Carburetor," slide/tape 213-4; "Overhaul a Two Barrell Rochester Carburetor, slide/tape 213-5; "Overhaul a Chrysler Two Barrell Carburetor," slide/tape 213-6; "Overhaul a Two Barrell Ford Type Carburetor," slide/tape 213-7
c. Bergwall, "The Operation of the Fuel System," filmstrip
d. Prentice-Hall, "Fuel Service," filmstrip
e. Ford, "Carburetor Service," slide/tape

TASK

VM-22 Reassembling and testing carburetor

PERFORMANCE OBJECTIVE

Reassemble and test carburetor.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Carburetion
b. Carburetor circuits
c. Carburetor gage tools
d. Instrumentation

Provide Demonstration On:

a. Carburetor assembly
b. Carburetor circuits adjustments
c. Carburetor installation
d. Instrument test

Provide Practical Application On:

a. Assembling 2BBL and 4BBL carburetor
b. Carburetor circuit adjustment
c. Carburetor installation
d. Instrument testing

INSTRUCTIONAL MATERIALS

Textbooks:

a. Crouse and Anglin, *Automotive Fuel, Lubricating and Cooling Systems*
b. Stockel, *Auto Service and Repair*

A/Vs:

Bergwall, "How to Overhaul a Carburetor," filmstrip

Tools and Equipment:

a. Hand tools
b. Carburetor repair tools
c. Dwell tach
d. Auto shop repair manual

LAB HOURS 4
CLASS HOURS 6

EVALUATION (VM-22)

a. Given a 2BBL or 4BBL carburetor, an operational automotive engine and necessary tools and equipment, the student will assemble carburetor to standards of auto shop repair manual. The student will install carburetor on engine and make necessary adjustments to meet manufacturer's standards.

b. Crouse and Anglin, The Auto Book and Auto Study Guide.

c. Bergwall, filmstrip questions.

d. Hughes, Guide to the Automobile Mechanic Certification Exam.

e. V'TECS, Automotive Mechanics, Task No. 118.

f. Georgia Student Assessment System, Domain Referenced Tests, Transportation/Automotive Mechanics, Volume I, II.

g. Oklahoma, Auto Mechanics I.

TASK

VM-23 Testing and replacing fuel pumps

PERFORMANCE OBJECTIVE

Test and replace fuel pumps.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Fuel systems
b. Fuel pumps
c. Fuel lines

Provide Demonstration On:

a. Using a fuel pump pressure gage
b. Using a fuel pump flow meter
c. Replacing manual fuel pump
d. Replacing electric fuel pump

Provide Practical Application On:

a. Using a fuel pump pressure gage
b. Using a fuel pump flow meter
c. Replacing manual fuel pump
d. Replacing electric fuel pump

INSTRUCTIONAL MATERIALS

Textbooks:

a. Crouse and Anglin, *Automotive Fuel, Lubricating and Cooling Systems*
b. Stockel, *Auto Service and Repair*

A/Vs:

a. Georgia, Transportation Cluster, "Testing and Replacing the Fuel Pump," slide/tape FS-2

Student Manuals:

a. Georgia, *Transportation Cluster*, Unit FS-2
b. Georgia, *Auto Mechanics*, Unit 213-2
c. Oklahoma, *Auto Mechanics I*

Tools and Equipment:

a. Hand tools
b. Pressure gage
c. Flow meter

(Continued on back)

LAB HOURS	2
CLASS HOURS	4

EVALUATION (VM-23)

a. Given an operational automobile fuel system and necessary tools and equipment, the student will test and/or replace the fuel pump according to standards of auto shop repair manual.

b. Crouse and Anglin, *The Auto Book* and *Auto Study Guide*.

c. Bergwall, filmstrip questions.

d. Hughes, *Guide to the Automobile Mechanic Certification Exam*.

e. V'TECS, *Automotive Mechanics*, Task Nos. 119, 122.

f. Georgia Student Assessment System, *Domain Referenced Tests*, Transportation/Automotive Mechanics, Volume I, II.

g. Oklahoma, *Auto Mechanics I*.

INSTRUCTIONAL MATERIALS

A/Vs:

b. Georgia, *Auto Mechanics*, "Test and Replace Fuel Pump," slide/tape 213-2
c. Bergwall, "The Operation of the Fuel System," filmstrip

TASK

VM-24 Servicing fuel tank, lines, hoses and fuel level monitoring devices

PERFORMANCE OBJECTIVE

Service fuel tank, lines, hoses and fuel level monitoring devices.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Fuel systems
b. Fuel lines
c. Fuel gauges
d. Volt-ohmmeter

Provide Demonstration On:

a. Removal and service of fuel tank
b. Servicing fuel gage dash unit
c. Servicing fuel gage tank sending unit

Provide Practical Application On:

a. Removing and servicing fuel tank
b. Removing and servicing dash unit fuel gage
c. Removing and servicing tank sending unit

INSTRUCTIONAL MATERIALS

Textbooks:

a. Crouse and Anglin, Automotive Fuel, Lubricating and Cooling Systems
b. Stockel, Auto Service and Repair

A/Vs:

a. Georgia, Transportation Cluster, "Cleaning and Repairing the Fuel System Components," slide/tape FS-1

(Continued on back)

Student Manuals:

a. Georgia, Transportation Cluster, Unit FS-1
b. Georgia, Auto Mechanics, Unit 213-1
c. Oklahoma, Auto Mechanics I

Tools and Equipment:

a. Hand tools
b. Volt-ohmmeter

LAB HOURS 2
CLASS HOURS 6

EVALUATION (VM-24)

a. Given an operational automotive fuel system and necessary tools and equipment, the student will service and test the fuel tank, lines and hoses. The student will also service and test the dash gage unit and the tank gage unit according to standards of auto shop repair manual.

b. Crouse and Anglin, The Auto Book and Auto Study Guide.

c. Bergwall, filmstrip questions.

d. Hughes, Guide to the Automobile Mechanics Certification Exam.

e. V'TECS, Automotive Mechanics, Task Nos. 109, 117, 123.

f. Georgia Student Assessment System, Domain Referenced Tests, Transportation/Automotive Mechanics, Volume I, II.

g. Oklahoma, Auto Mechanics I.

INSTRUCTIONAL MATERIALS

A/Vs:

b. Georgia, Auto Mechanics, "Clean or Repair Fuel Tank or Lines," slide/tape 213-1

c. Bergwall, "The Operation of the Fuel System," filmstrip

TASK

VM-25 Diagnosing fuel system problems

PERFORMANCE OBJECTIVE

Diagnose fuel system problems.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Fuels
b. Carburetion
c. Instrumentation
d. Filters
e. Carburetor circuits

Provide Demonstration On:

a. Carburetor with low or high float
b. Clogged fuel filter
c. Maladjusted air/fuel mixture
d. Improper or non-functional fuel filter
e. Maladjusted accelerator pump

Provide Practical Application On:

a. Locating carburetor low or high float level
b. Locating clogged fuel filter

(Continued on back)

INSTRUCTIONAL MATERIALS

Textbooks:

a. Crouse and Anglin, *Automotive Fuel, Lubricating and Cooling Systems*
b. Stockel, *Auto Service and Repair*

A/Vs:

a. Georgia, Transportation Cluster, "Cleaning and Repairing the Fuel System Components," slide/tape FS-1; "Testing and Replac-

(Continued on back)

Student Manuals:

a. Oklahoma, *Auto Mechanics I*
b. Ford, *Carburetor Diagnosis*

Tools and Equipment:

a. Hand tools
b. Dwell tach
c. Carburetor repair tools
d. Pressure gage
e. Volt-ohmmeter
f. Auto shop repair manual

LAB HOURS 2

CLASS HOURS 4

EVALUATION (VM-25)

a. Given an operational automotive engine with an inoperative fuel system and necessary tools and equipment, the student will develop a troubleshooting plan and determine the cause of the problem within double the standard of flat rate time.

b. Crouse and Anglin, The Auto Book and Auto Study Guide.

c. Bergwall, filmstrip questions.

d. Hughes, Guide to the Automobile Mechanic Certification Exam.

e. Oklahoma, Auto Mechanics I.

INSTRUCTIONAL MATERIALS

A/Vs:

ing the Fuel Pump," slide/tape FS-2; "Overhauling a Single Barrell Carburetor," slide/tape FS-2A; "Overhauling a Single Barrell Carburetor," slide/tape FS-3B; "Inspect, Assemble, Adjust a Single Barrell Carburetor," slide/tape FS-5; "Overhauling a Two Barrell Rochester Carburetor," slide/tape FS-5A; "Overhauling a Two Barrell Carburetor," slide/tape FS-5B

b. Bergwall, "The Operation of the Fuel System," filmstrip

TASK

VM-26 Inspecting, selecting and installing spark plugs

PERFORMANCE OBJECTIVE

Inspect, select and install spark plugs.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Ignition secondary circuit
b. Spark plugs
c. Instrumentation

Provide Demonstration On:

a. Spark plug removal/installation
b. Spark plug construction
c. Effects of wrong spark plug heat range
d. Spark plug selection

Provide Practical Application On:

a. Spark plug removal
b. Spark plug selection by engine type and plug heat range
c. Spark plug installation

INSTRUCTIONAL MATERIALS

Textbooks:

a. Crouse and Anglin, Automotive Tune-Up
b. Wetzel, Automotive Diagnosis and Tune-Up

A/Vs:

a. Bergwall, "The Ignition System," filmstrip
b. Prentice-Hall, "Electrical Ignition Service," filmstrip

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Student Manuals:

a. Georgia, Transportation Cluster, Units SPS-1 - SPS-5
b. Georgia, Auto Mechanics, Unit 223-9
c. Oklahoma, Auto Mechanics II

Tools and Equipment:

(Continued on back)

LAB HOURS 2

CLASS HOURS 4

EVALUATION (VM-26)

a. Given an operational automotive engine and necessary tools and equipment, the student will remove, select and install spark plugs according to standards of auto shop repair manual.

b. Crouse and Anglin, Automotive Tune-Up.

c. Wetzel, Automotive Diagnosis and Tune-Up.

d. Bergwall, filmstrip questions.

e. Hughes, Guide to Automobile Mechanic Certification Exam.

f. V'TECS, Automotive Mechanics, Task No. 78.

g. Georgia Student Assessment System, Domain Referenced Tests, Transportation/Automotive Mechanics, Volume I, II.

h. Oklahoma, Auto Mechanics II.

INSTRUCTIONAL MATERIALS

A/Vs:

c. Georgia, Transportation Cluster, "Removing Spark Plugs from the Engine," slide/tape SPS-1, "Cleaning Spark Plugs," slide/tape SPS-2; "Gapping Spark Plugs," slide/tape SPS-3; "Testing Spark Plugs," slide/tape SPS-4; "Installing Spark Plugs," slide/tape SPS-5

Tools and Equipment:

a. Hand tools
b. Dwell tach
c. Spark plug gapping tool
d. Spark plug cleaner/tester
e. Auto shop manual

TASK

VM-27 Timing the ignition

PERFORMANCE OBJECTIVE

Time the ignition.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Ignition system
b. Instrumentation
c. Timing requirements

Provide Demonstration On:

a. Using dwell tach meter
b. Using timing light
c. Timing the ignition

Provide Practical Application On:

a. Using dwell tach
b. Using timing light
c. Timing the ignition

INSTRUCTIONAL MATERIALS

Textbooks:

a. Crouse and Anglin, Automotive Tune-Up
b. Wetzel, Automotive Diagnosis and Tune-Up

A/Vs:

a. Georgia, Transportation Cluster, "Installing a Distributor," slide/tape TID-4
b. Bergwall, "The Ignition System," filmstrip

Student Manuals:

a. Georgia, Transportation Cluster, Unit TID-5
b. Oklahoma, Auto Mechanics II

Tools and Equipment:

a. Hand tools
b. Dwell tach
c. Timing light
d. Auto shop repair manual

LAB HOURS	0
CLASS HOURS	2

EVALUATION (VM-27)

a. Given an operational automotive engine and necessary tools and equipment, the student will set the timing within one degree of specifications of auto shop repair manual.

b. Crouse and Anglin, Automotive Tune-Up.

c. Wetzel, Automotive Diagnosis and Tune-Up.

d. Bergwall, filmstrip questions.

e. Hughes, Guide to the Automobile Mechanic Certification Exam.

f. V'TECS, Automotive Mechanics, Task No. 103.

g. Oklahoma, Auto Mechanics II.

TASK

VM-28 Inspecting and replacing circuit wiring, distributor cap and rotor

PERFORMANCE OBJECTIVE

Inspect and replace circuit wiring, distributor cap and rotor.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Ignition system
b. Secondary ignition circuit
c. Distributor cap and rotor
d. Engine firing orders

Provide Demonstration On:

a. Replacing circuit wiring
b. Replacing distributor cap and rotor
c. Testing circuit wiring

Provide Practical Application On:

a. Replacing circuit wiring
b. Replacing distributor cap and rotor
c. Testing circuit wiring

INSTRUCTIONAL MATERIALS

Textbooks:

a. Crouse and Anglin, Automotive Tune-Up
b. Wetzel, Automotive Diagnosis and Tune-Up

A/Vs:

a. Bergwall, "The Ignition System," filmstrip
b. Georgia, Auto Mechanics, "Replace Distributor Cap and Spark Plug Wires," slide/tape 223-8

Student Manuals:

a. Georgia, Auto Mechanics, Unit 223-8
b. Oklahoma, Auto Mechanics II

Tools and Equipment:

a. Hand tools
b. Dwell tach
c. Volt-ohmmeter
d. Auto shop repair manual

LAB HOURS	2
CLASS HOURS	4

EVALUATION (VM-28)

a. Given an operational automotive engine and necessary tools and equipment, the student will inspect, test and replace circuit wiring, distributor cap and rotor according to specifications of auto shop repair manual.

b. Crouse and Anglin, Automotive Tune-Up.

c. Wetzel, Automotive Diagnosis and Tune-Up.

d. Bergwall, filmstrip questions.

e. Hughes, Guide to the Automobile Mechanic Certification Exam.

f. V'TECS, Automotive Mechanics, Task No. 80.

g. Georgia Student Assessment System, Domain Referenced Tests, Transportation/Automotive Mechanics, Volume I, II.

h. Oklahoma, Auto Mechanics II.

TASK

VM-29 Testing, removing and replacing battery ignition components

PERFORMANCE OBJECTIVE

Test, remove and replace battery ignition components.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Ignition breaker points
b. Ignition condenser
c. Ignition coil
d. Ignition wire coil to points
e. Breaker plate
f. Instrumentation

Provide Demonstration On:

a. Replacing breaker points
b. Testing coil and condenser
c. Testing coil to wire to points
d. Inspecting/replacing breaker plate

Provide Practical Application On:

a. Replacing and setting breaker points
b. Testing/replacing condenser
c. Testing/replacing coil
d. Testing/replacing ignition wire coil to points
e. Inspecting/replacing breaker plate

INSTRUCTIONAL MATERIALS

Textbooks:

a. Crouse and Anglin, Automotive Tune-Up
b. Wetzel, Automotive Diagnosis and Tune-Up

A/Vs:

a. Ford, "Ignition Systems," slide/tape
b. Georgia, Transportation Cluster, "Testing Ignition Coil and Condenser," slide/tape TIC-1; "Testing Igni-

(Continued on back)

Student Manuals:

a. Georgia, Transportation Cluster, Units TIC-1,2; TID-3
b. Georgia, Auto Mechanics, Unit 223-10

Tools and Equipment:

a. Hand tools
b. Dwell tach
c. Coil condenser tester
d. Volt-ohmmeter
e. Auto shop repair manual

LAB HOURS	2
CLASS HOURS	6

EVALUATION (VM-29)

a. Given an operational automotive engine and necessary tools and equipment, the student will test, inspect, remove and replace battery ignition components according to specifications of auto shop repair manual.

b. Crouse and Anglin, The Auto Book; Auto Study Guide; Automotive Tune-Up.

c. Wetzel, Automotive Diagnosis and Tune-Up.

d. Bergwall, filmstrip questions.

e. Hughes, Guide to the Automobile Mechanic Certification Exam.

f. V'TECS, Automotive Mechanics, Task Nos. 81, 82, 96, 99, 100.

g. Georgia Student Assessment System, Domain Referenced Tests, Transportation/Automotive Mechanics, Volume I, II.

h. Oklahoma, Auto Mechanics II.

INSTRUCTIONAL MATERIALS

A/Vs:

tion Coil and Condenser," slide/tape TIC-2; "Installing Points in a Distributor," slide/tape TID-3; "Test Ignition Coil and Condenser," slide/tape 223-10

c. Bergwall, "How To Do Major Engine Tune-Up," filmstrip; "The Ignition System," filmstrip

d. Prentice-Hall, "Electrical Ignition Service," filmstrip

TASK

VM-30 Testing, removing and replacing electronic ignition components

PERFORMANCE OBJECTIVE

Test, remove and replace electronic ignition components.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Point-controlled
b. Magnetic-pulse or breakerless
c. Photoelectric cell
d. Light-emitting diode
e. Capacitor discharge

Provide Demonstration On:

a. Testing, removing and replacing components, point-controlled
b. Testing, removing and replacing magnetic-pulse or breakerless
c. Testing, removing and replacing photoelectric cell
d. Testing, removing and replacing light-emitting diode
e. Testing, removing and replacing capacitor discharge

Provide Practical Application On:

(Continued on back)

INSTRUCTIONAL MATERIALS

Textbooks:

a. Crouse and Anglin, Automotive Tune-Up
b. Johnson, Automotive Diagnosis and Tune-Up

A/Vs:

a. Bergwall, "Electronic Ignition Explained," filmstrip
b. Ford, "Solid State Ignition Systems," slide/tape

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Student Manuals:

a. Ford, Solid State Ignition Systems
b. Georgia, Auto Mechanics, Unit 262-4
c. Oklahoma, Auto Mechanics II

Tools and Equipment:

(Continued on back)

LAB HOURS 4

CLASS HOURS 6

EVALUATION (VM-30)

a. Given an operational automotive engine containing one of the five major electronic ignition systems, necessary tools and equipment, the student will identify the system and test, remove and replace electronic ignition components according to specifications of auto shop repair manual.

b. Crouse and Anglin, The Auto Book; Auto Study Guide; Automotive Tune-Up.

c. Johnson, Automotive Diagnosis and Tune-Up.

d. Bergwall, filmstrip questions.

e. Hughes, Guide to the Automobile Mechanic Certification Exam.

f. V'TECS, Automotive Mechanics, Task No. 107.

g. Oklahoma, Auto Mechanics II.

INSTRUCTIONAL ACTIVITIES

Provide Practical Application On:

a. Testing, removing and replacing components, point-controlled
b. Testing, removing and replacing components in magnetic-pulse or breakerless
c. Testing, removing and replacing components in photoelectric cell
d. Testing, removing and replacing components in light-emitting diode
e. Testing, removing and replacing components in capacitor discharge

INSTRUCTIONAL MATERIALS

A/Vs:

c. Prentice-Hall, "Electronic Ignition Service, filmstrip
d. Georgia, Auto Mechanics, "Ignition System for 1972," slide/tape 262-4

Tools and Equipment:

a. Hand tools
b. Dwell tach
c. Voltmeter
d. Ohmmeter
f. Auto shop manual

TASK

VM-31 Using and interpreting the ignition analyzer

PERFORMANCE OBJECTIVE

Use and interpret the ignition analyzer.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Initial set up and lead connections
b. Interpreting scope patterns
c. Programming scope controls
d. Meter usage

Provide Demonstration On:

a. Setting up and testing lead connections
b. Standard ignition testing
c. Electronic ignition testing
d. Meter and gage testing

Provide Practical Application On:

a. Initial set up and test lead connections
b. Testing standard ignition
c. Testing electronic ignition
d. Meter and gage testing

INSTRUCTIONAL MATERIALS

Textbooks:

a. Crouse and Anglin, Automotive Tune-Up
b. Johnson, Automotive Diagnosis and Tune-Up
c. Sun Electric Corp., Ignition Analyzer Handbook
d. Wetzel, Automotive Diagnosis and Tune-Up

A/Vs:

a. Bergwall, "The Ignition System," filmstrip

(Continued on back)

Student Manuals:

a. Georgia, Transportation Cluster, Units STE-3-6
b. Georgia, Auto Mechanics, Units 223-12

Tools and Equipment:

a. Hand tools
b. Tune-up ignition analyzer
c. Auto shop repair manual

LAB HOURS 4
CLASS HOURS 6

EVALUATION (VM-31)

a. Given an ignition analyzer, operational automotive engine and necessary tools and equipment, the student will set up and use and test the ignition system. The analyzer recorded readings must be within 5% of actual known values.

b. Johnson, Automotive Diagnosis and Tune-Up.

c. Wetzel, Automotive Diagnosis and Tune-Up.

d. Crouse and Anglin, Automotive Tune-Up.

e. Hughes, Guide to the Automobile Mechanic Certification Exam.

f. V'TECS, Automotive Mechanics, Task No. 75.

INSTRUCTIONAL MATERIALS

A/Vs:

b. Ford, "Ignition System Diagnosis and Adjustment," transparency
c. Georgia, Auto Mechanics, "Engine Diagnosis with Sun Scope," slide/tape 223-12A; "Performing Engine Tests," slide/tape STE-3; "Identifying Scope Patterns," slide/tape STE-4; "Testing Firing System with a Scope," slide/tape STE-5; "Running Power Balance Test on Cylinder," slide/tape STE-6

TASK

VM-32 Diagnosing ignition system problems

PERFORMANCE OBJECTIVE

Diagnose ignition system problems.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Ignition system (conventional)
b. Ignition system (electronic)
c. Instrumentation

Provide Demonstration On:

a. Diagnosing problems in ignition system (conventional)
b. Diagnosing problems in ignition system (electronic)
c. Using instruments to diagnose ignition system problems

Provide Practical Application On:

a. Diagnosing problems in ignition system (conventional)

(Continued on back)

INSTRUCTIONAL MATERIALS

Textbooks:

a. Crouse and Anglin, Automotive Tune-Up
b. Johnson, Automotive Diagnosis and Tune-Up
c. Sun Electric Corp., Ignition Analyzer Handbook
d. Wetzel, Automotive Diagnosis and Tune-Up

A/Vs:

a. Bergwall, "The Ignition System," filmstrip

(Continued on back)

Tools and Equipment:

a. Hand tools
b. Tune-up ignition analyzer
c. Hand held meters
d. Auto shop repair manual

LAB HOURS 4
CLASS HOURS 4

EVALUATION (VM-32)

a. Given an operational automotive engine with faulty ignition system and necessary tools and equipment, the student will formulate a troubleshooting plan and locate the problem in double the flat rate time.

b. Johnson, Automotive Diagnosis and Tune-Up.

c. Wetzel, Automotive Diagnosis and Tune-Up.

d. Crouse and Anglin, Automotive Tune-Up.

e. Hughes, Guide to the Automobile Mechanic Certification Exam.

f. Georgia Student Assessment System, Domain Referenced Tests, Transportation/Automotive Mechanics, Volume I, II.

INSTRUCTIONAL ACTIVITIES

Provide Practical Application On:

b. Diagnosing problems in ignition system (electronic)
c. Using instruments to diagnose ignition system problems

INSTRUCTIONAL MATERIALS

A/Vs:

b. Prentice-Hall, "Electrical Ignition Service," filmstrip; "Electronic Ignition Service," filmstrip

TASK

VM-33 Servicing battery and cables

PERFORMANCE OBJECTIVE

Service battery and connecting cables.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Battery construction
b. Battery maintenance and testing
c. Cable maintenance and testing

Provide Demonstration On:

a. Battery maintenance
b. Battery testing
c. Cable maintenance

Provide Practical Application On:

a. Battery maintenance
b. Testing battery
c. Testing cable

INSTRUCTIONAL MATERIALS

Textbooks:

a. Crouse and Anglin, The Auto Book
b. Wetzel, Automotive Diagnosis and Tune-Up

A/Vs:

a. Prentice-Hall, "Basic Automotive Service," filmstrip; "How the Automobile Works," filmstrip

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Student Manuals:

a. Georgia, Transportation Cluster, Unit TSB-1
b. Georgia, Auto Mechanics, Unit 201-4
c. Oklahoma, Auto Mechanics II

Tools and Equipment:

(Continued on back)

LAB HOURS 2
CLASS HOURS 2

EVALUATION (VM-33)

a. Given an operational automotive starting system and necessary tools and equipment, the student will test and service the battery and cables according to standards in the auto shop repair manual or manufacturer's specifications.

b. Wetzel, Automotive Diagnosis and Tune-Up.

c. Crouse and Anglin, The Auto Book and Auto Study Guide.

d. Hughes, Guide to the Automobile Mechanic Certification Exam.

e. Oklahoma, Auto Mechanics II.

f. V'TECS, Automotive Mechanics, Task No. 102.

g. Georgia Student Assessment System, Domain Referenced Tests, Transportation/Automotive Mechanics, Vol. I, II.

INSTRUCTIONAL MATERIALS

A/Vs:

b. Georgia, Transportation Cluster, "Testing Battery Gravity," slide/tape TSB-1; "Performing Light Load Test on Battery," slide/tape TSB-2A; "Testing the Battery with Cell Probes," slide/tape TSB-2B; "Testing a Battery for Capacity," slide/tape TSB-3; "Cleaning the Battery," slide/tape TSB-4; "Charging a Battery," slide/tape TSB-5
c. Georgia, Auto Mechanics, "Test and Service Storage Battery," slide/tape 201-4A

Tools and Equipment:

a. Hand tools
b. Hydrometer
c. Volt-ampmeter
d. Battery service tools
e. Auto shop repair manual

TASK

C-01 Reading a rule

PERFORMANCE OBJECTIVE

Read a rule.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Identifying increments of an inch
b. Identifying measurement devices
c. Recognizing fractions
d. Adding and subtracting
e. Reading specific measurements
f. Measuring with a rule
g. Identifying the major parts of a framing square
h. Measuring with a framing square

Provide Demonstration On:

a. Adding and subtracting fractions
b. Measuring with a rule
c. Measuring with a framing square

Provide Practical Application On:

a. Identifying increments of an inch
b. Adding and subtracting fractions
c. Measuring with a rule
d. Measuring with a framing square

INSTRUCTIONAL MATERIALS

Textbooks:

a. Feirer and Hutchings, Carpentry and Building Construction
b. Wagner, Modern Carpentry

Student Manuals:

Georgia, Construction Cluster, Units ML 1a and 2

Tools and Equipment:

a. Rule
b. Framing square

LAB HOURS	5
CLASS HOURS	5

EVALUATION (C-01)

Given a rule and framing square, the student will identify all 1/16" measurements with 100% accuracy.

TASK

C-02 Reading a scale

PERFORMANCE OBJECTIVE

Read a scale.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Identifying types of architect's scale
b. Identifying and listing scales on architect's scale
c. Scaling with architect's scale

Provide Demonstration On:

Using an architect's scale

Provide Practical Application On:

Scaling lines

INSTRUCTIONAL MATERIALS

Textbooks:

a. Feirer and Hutchings, Carpentry and Building Construction
b. Wagner, Modern Carpentry

Student Manuals:

Georgia, Construction Cluster, Unit BR-1

Tools and Equipment:

a. Architectural scale
b. Paper
c. Pencils

LAB HOURS 2
CLASS HOURS 2

EVALUATION (C-02)

Given lines of different lengths and an architect's scale, the student will measure the length of each line. Each line will be to the correct scale and length.

TASK

C-03 Reading orthographic drawings

PERFORMANCE OBJECTIVE

Read orthographic drawings.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Recognizing the principles of orthographic drawing
b. Identifying the views in an orthographic drawing
c. Matching orthographic views to a pictorial drawing

Provide Demonstration On:

Reading orthographic drawings

Provide Practical Application On:

Reading orthographic drawings

INSTRUCTIONAL MATERIALS

Textbooks:

a. Feirer and Hutchings, Carpentry and Building Construction
b. Wagner, Modern Carpentry

Student Manuals:

Georgia, Construction Cluster, Unit BR-2

Tools and Equipment:

Blueprints

LAB HOURS	1
CLASS HOURS	1

EVALUATION (C-03)

Given questions on orthographic drawings, the student will answer questions with 80% accuracy.

TASK

C-04 Identifying elevations

PERFORMANCE OBJECTIVE

Identify elevations.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Identifying different elevation views of a drawing
b. Identifying needed details from a drawing elevation

Provide Demonstration On:

a. Identifying different elevation views of a drawing
b. Sketching elevation views
c. Listing and identifying needed drawing details from an elevation

Provide Practical Application On:

Identifying different elevations and securing basic information from a set elevations

INSTRUCTIONAL MATERIALS

Textbooks:

a. Feirer and Hutchings, Carpentry and Building Construction
b. Wagner, Modern Carpentry

Student Manuals:

Georgia, Construction Cluster, Unit BR-3

Tools and Equipment:

Blueprints

LAB HOURS 1

CLASS HOURS 1

EVALUATION (C-04)

Given house elevations, the student will secure basic building information. All details will be identified with 100% accuracy.

TASK

C-05 Identifying symbols

PERFORMANCE OBJECTIVE

Identify symbols.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Recognizing principles of symbol representation
b. Identifying symbols from floor plans
c. Identifying drawing notations related to building parts and materials
d. Determing basic information from floor plan drawings
e. Listing specific details from floor plans
f. Reading a floor plan drawing for needed dimensions
g. Listing dimensions from a floor plan

Provide Demonstration On:

Interpreting symbols

Provide Practical Application On:

Interpreting symbols

INSTRUCTIONAL MATERIALS

Textbooks:

a. Feirer and Hutchings, Carpentry and Building Construction
b. Wagner, Modern Carpentry

Student Manuals:

Georgia, Construction Cluster, Units BR 4-6

Tools and Equipment:

Blueprints

LAB HOURS 1

CLASS HOURS 1

EVALUATION (C-05)

Given blueprints, the student will identify various symbols or notations related to building parts and materials and designate specific components and dimensions of the house with 80% accuracy.

TASK

C-06 Using hand tools (tooth cutting, edge cutting, boring, assembly and smoothing tools)

PERFORMANCE OBJECTIVE

Use hand tools.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Sharpening procedures
b. Maintenance and care of home tools
c. How to use hand tools
d. Identification of different hand tools

Provide Demonstration On:

a. Naming tools
b. Sharpening tools
c. Using hand tools properly and safely
   1. Sawing cross-grain to a square line
   2. Ripping with the grain to a scribbed line
   3. Sawing curved or radius line with coping saw

INSTRUCTIONAL MATERIALS

Textbooks:

a. Lewis, Safety for Carpenters and Woodworkers
b. McDonnell and Kaumeheiwa, The Use of Hand Woodworking Tools
c. Dahl and Wilson, Cabinet Making and Millwork
d. Groneman and Glazener, Technical Woodworking
e. Jones, Basic Cabinetmaking

A/Vs:

Bergwall, "Woodworking Hand Tools Explained," filmstrip

Tools and Equipment:

a. Hand saw
b. Drill
c. Hammer
d. Nail set
e. Hand plane
f. Cabinet scraper

LAB HOURS	4
CLASS HOURS	6

EVALUATION (C-06)

a. Given tools and supplies, the student will cut curved lines and holes in pieces of stock and cut and rip boards to a line. Boards must be square to the edge and to the face.

b. Lewis, Safety for Carpenters and Woodworkers.

c. Dahl and Wilson, Cabinet Making and Millwork.

d. McDonnell and Kaumeheiwa, The Use of Hand Woodworking Tools.

TASK

C-07 Using measuring tools

PERFORMANCE OBJECTIVE

Use measuring tools.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Measuring cut pieces of wood
b. Measuring openings
c. Scribing lines
d. Squaring across stock
e. Laying out and checking 90° and 45° angles

Provide Demonstration On:

a. Measuring lengths
b. Measuring openings
c. Squaring lines
d. Checking for 45° angles

Provide Practical Application On:

a. Measuring lines
b. Squaring lines
c. Scribing lines

INSTRUCTIONAL MATERIALS

Textbooks:

a. Dahl and Wilson, Cabinet Making and Millwork
b. Lewis, Safety for Carpenters and Woodworkers
c. McDonnell and Kaumeheiwa, The Use of Hand Woodworking Tools

Tools and Equipment:

a. Rules - 6" folding and 6" extension
b. 10" tapes
c. Steel square
d. Combination square

LAB HOURS 1

CLASS HOURS 1

EVALUATION (C-07)

Given tools and supplies, the student will measure opening, width and length of board of plywood. The measurement must be within 1/16th inch.

TASK

C-08 Using fasteners (nails, screws, glue)

PERFORMANCE OBJECTIVE

Use fasteners.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Sizes and kinds of nails
b. Sizes and kinds of screws
c. Drilling procedures for using screws
d. How to measure screws
e. Kinds of glue
f. Types of clamps
g. Gluing and clamping procedure
h. Ways to apply glue

Provide Demonstration On:

a. Driving nails
b. Setting nails
c. Driving screws
d. Gluing
e. Clamping

Provide Practical Application On:

a. Using screws and nails to fasten wood items
b. Gluing and clamping wood items

INSTRUCTIONAL MATERIALS

Textbooks:

a. Dahl and Wilson, Cabinet Making and Millwork
b. Lewis, Safety for Carpenters and Woodworkers

Tools and Equipment:

a. Hammer
b. Nails
c. Screws
d. Nail set
e. Glue
f. Clamps

LAB HOURS 2
CLASS HOURS 4

EVALUATION (C-08)

a. Given tools and supplies, the student will drive and set nails and use screws to fasten wood parts. The student will describe kinds and sizes of nails and screws and use correct techniques to install fasteners.

c. Lewis, Safety for Carpenters and Woodworkers.

TASK

C-09 Using portable power tools (saws, drills, router and sanders)

PERFORMANCE OBJECTIVE

Use portable power tools.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Tool selection (the right tool for the job)
b. Sanders, routers, saws and drills
c. Proper selection of drill bits, router bits, saws and sandpaper

Provide Demonstration On:

a. Sanding an item made of wood
b. Drilling holes
c. Routing
d. Sawing with portable electric saw

Provide Practical Application On:

Using portable power tools

INSTRUCTIONAL MATERIALS

Textbooks:

a. Dahl and Wilson, Cabinet Making and Millwork
b. Lewis, Safety for Carpenters and Woodworkers
c. Jones, Basic Cabinetmaking
d. Drake, Everyone's Book of Hand and Small Powered Tools

A/Vs:

a. Career Aids, "Woodworking Power Tools Series," filmstrip

(Continued on back)

Tools and Equipment:

a. 24" belt sander
b. Electric hand saw (skill)
c. 3/8" and 1/2" drills
d. Portable router
e. Saber saw

LAB HOURS 10

CLASS HOURS 10

EVALUATION (C-09)

a. Given tools and supplies, the student will sand items made of wood, drill holes for screws and bolts, cut boards or plywood with skill saw and rout with portable router. The student will also identify and use all portable power tools used in cabinetmaking.

b. Lewis, Safety for Carpenters and Woodworkers.

INSTRUCTIONAL MATERIALS

A/Vs:

b. Bergwall, "Woodworking Explained: Building a Better Bookshelf," filmstrip
c. Prentice-Hall, "Woodworking: Power Tools," filmstrip

TASK

C-10 Surfacing stock, jointing edges and dressing lumber to thickness

PERFORMANCE OBJECTIVE

Surface a board, dress to thickness and joint one edge straight.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Jointer
b. Planer
c. Safety on machines
d. Proper procedure
e. De Cristoforo

Provide Demonstration On:

a. Facing a piece of stock
b. Dressing a piece of stock
c. Jointing a piece of stock

INSTRUCTIONAL MATERIALS

Textbooks:

a. Lewis, Safety for Carpenters and Woodworkers
b. Dahl and Wilson, Cabinet Making and Millwork
c. Jones, Basic Cabinetmaking

A/Vs:

a. Career Aids, "Woodworking Power Tool Series," filmstrip
b. Career Aids, "Woodworking Machine Operations Explained," filmstrip

(Continued on back)

Tools and Equipment:

a. Jointer
b. Planer
c. Stack 12" long or longer

LAB HOURS	6
CLASS HOURS	6

EVALUATION (C-10)

a. Given equipment and supplies, the student will surface a board, dress to thickness and joint one edge straight.

b. Lewis, Safety for Carpenters and Woodworkers.

INSTRUCTIONAL MATERIALS

A/Vs:

c. Prentice-Hall, "Woodworking: Power Tools," filmstrip

TASK

C-11 Ripping stock

PERFORMANCE OBJECTIVE

Rip stock.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Setting up rip saw
b. Ripping material
c. Safety
d. Types of saw blades
e. Jobs that can be done on table saw (grooves, dadoes and rabbets)

Provide Demonstration On:

a. How to use machine for grooves, dadoes and rabbets
b. How to set up and rip material

Provide Practical Application On:

a. Setting up machine
b. Ripping stock

INSTRUCTIONAL MATERIALS

Textbooks:

a. Lewis, Safety for Carpenters and Woodworkers
b. Groneman and Glazener, Technical Woodworking

A/Vs:

a. Bergwall, "Woodworking Machine Operations Explained," filmstrip
b. Prentice-Hall, "Woodworking: Power Tools," filmstrip

(Continued on back)

Tools and Equipment:

a. Rule
b. Table saw
c. Material to use

LAB HOURS	6
CLASS HOURS	2

EVALUATION (C-11)

a. Given tools and supplies, the student will set up table saw, rip material to desired width and cut dadoes, rabbets and grooves.

b. Lewis, Safety for Carpenters and Woodworkers.

INSTRUCTIONAL MATERIALS

A/Vs:

c. Prentice-Hall, "Woodworking: Power Saws," filmstrip

TASK

C-12 Cutting stock to length

PERFORMANCE OBJECTIVE

Cut stock to length.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Types of saw blades
b. Changing blades
c. Safety procedures
d. Setting up procedures

Provide Demonstration On:

a. Cutting square
b. Cutting 45° angles
c. How to set stops
d. How to make adjustments
e. Blades to use

Provide Practical Application On:

a. Changing blades
b. Cutting material
c. Setting stops
d. Safety measures

INSTRUCTIONAL MATERIALS

Textbooks:

a. Lewis, Safety for Carpenters and Woodworkers
b. Dahl and Wilson, Cabinet Making and Millwork

Tools and Equipment:

a. Radial arm saw
b. Material to cut
c. Square
d. Clamps

LAB HOURS	3
CLASS HOURS	1

EVALUATION (C-12)

a. Given tools and equipment, the student will cut lumber and plywood to given length. The student will also describe and adjust the parts of the radial arm saw.

b. Lewis, Safety for Carpenters and Woodworkers.

TASK

C-13 Using the band saw and scroll saw

PERFORMANCE OBJECTIVE

Use the band saw and scroll saw.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Band saw blades
b. Removing and replacing blades
c. Making adjustment to the machine
d. Cutting material on band saw
e. Cutting inside and outside radius

Provide Demonstration On:

a. Setting up machine
b. Making adjustments
c. Cutting material on band saw
d. Safety

Provide Practical Application On:

a. Cutting material (radius)
b. Cutting miters
c. Cutting circles
d. Resawing stock
e. Adjusting saw

INSTRUCTIONAL MATERIALS

Textbooks:

Lewis, Safety for Carpenters and Woodworkers

A/Vs:

Bergwall, "Woodworking Machine Operations Explained," filmstrip

Tools and Equipment:

a. Band saw
b. Square
c. Pencil
d. Material

LAB HOURS 3
CLASS HOURS 3

EVALUATION (C-13)

a. Given tools and supplies, the student will cut radius pieces of material inside and outside, select and install blades and adjust machine so blade operates properly.

b. Lewis, Safety for Carpenters and Woodworkers.

TASK

C-14 Using the shaper and overarm router

PERFORMANCE OBJECTIVE

Use the shaper and overarm router.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. How to install cutters and adjust machine
b. Safety procedures
c. Types of cutters
d. Types of bits
e. Shaping with straight fence

Provide Demonstration On:

a. Selecting proper cutter
b. Setting up machines
c. Running stock to pattern

Provide Practical Application On:

a. Shaping material to a given pattern
b. Routing material using overarm router
c. Setting up and adjusting machine

INSTRUCTIONAL MATERIALS

Textbooks:

Lewis, Safety for Carpenters and Woodworkers

A/Vs:

Bergwall, "Woodworking Machine Operations Explained, " filmstrip

Tools and Equipment:

a. Patterns to follow
b. Shaper
c. Router
d. Stock

LAB HOURS	4
CLASS HOURS	8

EVALUATION (C-14)

a. Given tools, supplies and equipment, the student will describe the parts of the shapes and basic kinds of shaper cutters. The student will install and adjust cutters, shape straight work with a fence and set up and use the overarm router for routing operations.

b. Lewis, Safety for Carpenters and Woodworkers.

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TASK

C-15 Making wood joints

PERFORMANCE OBJECTIVE

Make basic wood joints.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Selecting the proper wood joint
b. Types of wood joints
c. Machines used to make joints
d. Safety

Provide Demonstration On:

a. Best joints for a given job
b. How to make joints
c. How joints should fit

Provide Practical Application On:

a. Making martice and tenon joints
b. Making dove tail joints
c. Making half lap joints
d. Making rabbet joints
e. Making tongue and groove joints
f. Making dado joints
g. Making spline joints

(Continued on back)

INSTRUCTIONAL MATERIALS

Textbooks:

a. Lewis, Safety for Carpenters and Woodworkers
b. Dahl and Wilson, Cabinet Making and Millwork

Tools and Equipment:

a. Materials
b. Square
c. Table saw
d. Radial armsaw
e. Router
f. Shaper

LAB HOURS	15
CLASS HOURS	5

EVALUATION (C-15)

a. Given tools, supplies and equipment, the student will make basic woodworking joints and list advantages and disadvantages of each joint.

b. Lewis, Safety for Carpenters and Woodworkers.

INSTRUCTIONAL ACTIVITIES

Provide Practical Application On:

h. Making a doweled edge joint
i. Making a miter joint

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TASK

C-16 Using the wood lathe to turn stock

PERFORMANCE OBJECTIVE

Use the wood lathe to turn stock.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Wood lathe (purpose and parts)
b. Chisels
c. Gouges
d. Spindle turning
e. Faceplate turning
f. Sanding

Provide Demonstration On:

a. Setting up machine
b. How to use chisels
c. Cuts made on lathe
d. How to sharpen and care for chisels

Provide Practical Application On:

a. Setting up and turn stock
b. Setting up and turn with faceplate
c. Sharpening chisels
d. Sanding items turned

INSTRUCTIONAL MATERIALS

Textbooks:

Lewis, Safety for Carpenters and Woodworkers

A/Vs:

Bergwall, "Woodworking Machine Operations Explained," filmstrip

Tools and Equipment:

a. Stock
b. Wood lathe
c. Chisels and gouges

LAB HOURS	5
CLASS HOURS	3

EVALUATION (C-16)

a. Given tools, supplies and equipment, the student will turn stock on wood lathe to a pattern or specific size and make a faceplate turning of a specified design.

b. Lewis, Safety for Carpenters and Woodworkers.

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TASK

C-17 Boring holes and cutting plugs

PERFORMANCE OBJECTIVE

Bore holes and cut plugs.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Kinds of wood bits
b. Sizes of wood bits
c. Drill press purpose
d. Plug cutters
e. Clamping materials for boring

Provide Demonstration On:

a. Boring holes
b. Cutting plug
c. Safety

Provide Practical Application On:

a. Boring hole square to work
b. Boring hole at an angle to the work
c. Cutting plugs for specific size hole

INSTRUCTIONAL MATERIALS

Textbooks:

Lewis, Safety for Carpenters and Woodworkers

A/Vs:

Bergwall, "Woodworking Machine Operations Explained," filmstrip

Tools and Equipment:

a. Drill press
b. Material
c. Bits
d. Plug cutters
e. Clamps
f. Rule

LAB HOURS	3
CLASS HOURS	2

EVALUATION (C-17)

a. Given tools, supplies and equipment, the student will drill holes to a specific size and cut plugs to a specific size.

b. Lewis, Safety for Carpenters and Woodworkers.

TASK

C-18 Sanding flat surfaces

PERFORMANCE OBJECTIVE

Sand flat surfaces.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Sanding machine
b. Sanding belts
c. Safety standards
d. Kinds of paper and grits available

Provide Demonstration On:

a. Operating belt sander
b. Operating disk sander
c. Operating a spindle sander

Provide Practical Application On:

a. Sanding flat surface
b. Sanding curved edge
c. Sanding with disk sander

INSTRUCTIONAL MATERIALS

Textbooks:

Lewis, Safety for Carpenters and Woodworkers

A/Vs:

Bergwall, "Woodworking Explained: Building a Better Bookshelf," filmstrip

Tools and Equipment:

a. Materials
b. Sanding machine
c. Sanding belts

LAB HOURS 2
CLASS HOURS 4

EVALUATION (C-18)

a. Given a disk sander and other necessary materials and equipment, the student will sand flat stock and curved edges.

b. Lewis, Safety for Carpenters and Woodworkers.

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